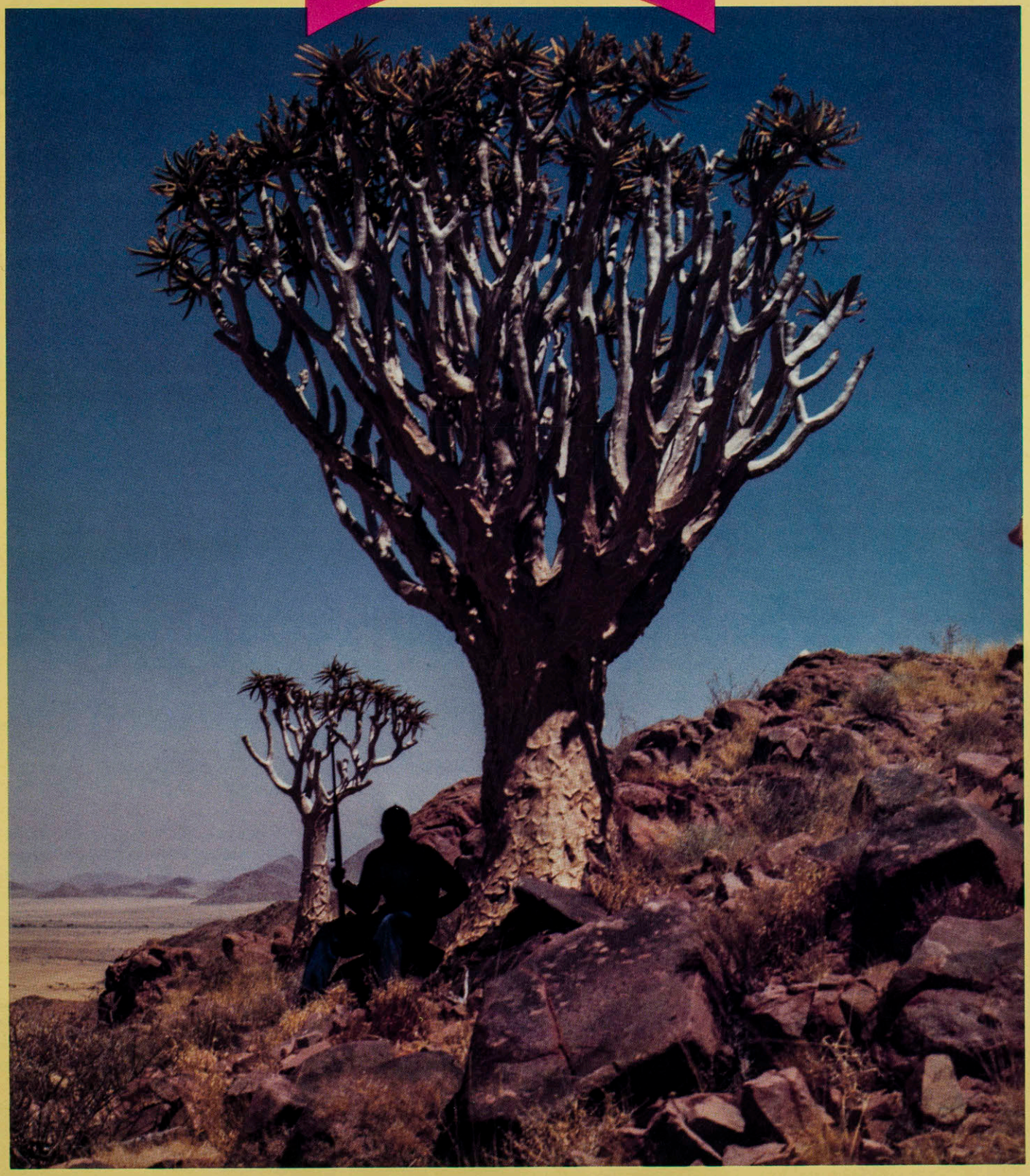
THE QUARTERLY MAGAZINE OF THE NATURAL HISTORY MUSEUM OF LOS ANGELES COUNTY
VOL. 12/NO. 1 SUMMER 1973

Terra



On The Go With Alliance Travelers

Ancient Civilizations of Mexico, Yucatan, Guatemala, Honduras and Peru

October 13–November 6, 1973 (If you wish you can join tour at any point.)

You will visit Machu-Picchu (8,000 feet high in the mountains), which is the most awe-inspiring sight in South America, only discovered and brought to the world's attention in 1911. You will explore Mexico's Monte Alban, with its ruins of the Zapotec ceremonial center, Palenque, immersed in its jungles, and Tikal abandoned in the 10th century and now being reclaimed. The Well of Sacrifice in Chichen Itza has remained one of the mysteries of Mayan civilization, while the decorated temples of Copan are world-renowned. The itinerary includes Mexico City, Oaxaca, Merida, Uxmal, Villahermosa, Guatemala City, Antique, Chichicastenango, Panama and Lima. Museum members may call Zenith Travel Service, Inc. (389-1231) for detailed brochure.

Southwest Indian Tour

Ten days in New Mexico and Arizona for a maximum of thirty adults. October 19th through October 28th fly to Albuquerque. By invitation you will visit Acoma Pueblo, the Zuni reservation, ail the villages of the three Hopi Mesas, Navajo Community College, Navajo tribal headquarters and Santo Domingo and Cochiti Pueblos. Enroute see the scenic wonders of the Painted Desert, Petrified Forest, Canyon de Chelly and the Chuska Mountains. Evening programs will include such noted artists as Pablita Velarde, Helen Hardin, Charles Loloma, Alvin James, Kenneth Begay, Charles Lovato and Serephina Ortiz—to name a few.

The cost is only $445.00 per person which covers round trip air fare from Los Angeles to Albuquerque, deluxe chartered bus, first class motels (double accommodation), entrance fees and demonstrations by craftsmen. Meals not included.

Shirley Brackett has planned and will guide the tour. Mrs. Brackett has done extensive traveling on all Southwest reservations, attends all Southwest Indian shows. She is a volunteer for Sherman Indian High School (Riverside). She is a friend of many of the outstanding Indian artists of the Southwest.

Call Mrs. Kellough at the Museum Alliance (749-3583) from 8 a.m. to 4 p.m., or after 5 p.m. Mrs. Brackett (375-2745) for additional information on itinerary or an application form.

Film Series

The Search For The Nile

James Mason narrates this series of six Emmy Award winning films to be shown on three evenings. Each film is one hour long and dramatically reconstructs one of the most spectacular quests of all times—the search for the source of the Nile.

The action was filmed on location in Africa and in England. The shooting was done around the Great Lakes of Central Africa and parts of Uganda and Tanzania.

The source of the Nile was the most challenging in mystery in the Victorian age. The river seemed to spring from nowhere, flowing in part of its course of 1,000 miles without a tributary or a drop of rain.

Five men took up the challenge and set out to discover the Nile's secret. Each hoping to carve a place for himself in the history books of the future.

Seating will be by advance reservation only. Send your request with a postage-paid self-addressed envelope to the MUSEUM ALLIANCE office. Reservations will be filled on first come, first served basis. Limited to 400 persons.

October 11, 8 P.M. The Dream of the Wanderer and Discovery and Betrayal.

October 18, 8 P.M. The Secret Fountains and The Great Debate.

October 25, 8 P.M. Find Livingstone and Conquest and Death.

Thank you, George Bartell

The editor of TERRA has received many letters commenting favorably on our Spring issue's cover illustration. In succinct graphic terms it caught the spirit and content of Sage Belt's feature article on Indian medicines. It was also very beautiful. Once again we are indebted to well known illustrator George Bartell for an outstanding contribution to the appearance of our magazine. Thank you, George Bartell.

The Cover

A plant that characterizes the western slopes of South West Africa's mountain system is the Kokerboom, a tree succulent (*Aloe dichotoma*). (Photo by C. Hogue)

Terra®

The Quarterly magazine of THE NATURAL HISTORY MUSEUM of Los Angeles County

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ZOOFARI TO AFRICA'S COOL DESERTS

by **Charles L. Hogue**

Ask each member of the Museum's recent Taylor South West Africa Expedition how their impressions of the country could be summed up in a single symbol and you will have five different answers: Dr. Robert Bezy, herpetologist, might suggest the call of a barking gecko; James Northern, ornithologist, perhaps would vote for the "Go-away Bird"; Lan Lester, mammalogist, could point to a baboon skull; Dr. Charles Hogue, entomologist, might propose a sand dune beetle; Mrs. Reese Taylor, expedition sponsor (known as "Maggie" to us and the staff of the Museum's bird section where she has worked as a volunteer for the past three years) undoubtedly thinks of the warm hospitality of the German and Afrikaaner ranchers who wrest product from this vast, lonely territory, and who graciously permitted us to camp on their properties. However varied their suggestions would be, they would all agree on the patency of one universal emblem worn by the land: the windmill. Each of the hundreds of "farms" (actually sheep, cattle and game ranches), and the location of all our camps were dependent upon these dogged slaves of the wind which laboriously pump from the ground the water needed to sustain animal and human life.

Partly because of its aridity, South West Africa was chosen as the site for a major Museum expedition. The factors influencing the choice of a desirable area to study and collect mammals, birds, reptiles, amphibians, and insects were (a) the antiquity and uniqueness of the fauna, (b) the relatively unresearched state of knowledge on most of these animal groups, and (c) the interest of the participants in tropical deserts. Also of importance was the availability of an excellent outfitter, capable of handling the tremendous logistic problems attending a trip of this magnitude and type.

We placed ourselves in the supremely capable hands of Mr. and Mrs. Basie Maartens (Basie Maartens Safaris). The Maartens employed assistant hunter Charles Ward and 12 native helpers to carry out the expedition. The specialized duties of the latter included cooking, laundry, tracking, tent throwing and other camp jobs of all kinds. Three Ovambo and one Basuto tribesmen were trained by Lester and Northern in the art of preparing small mammal and bird study skins and served as very capable assistant preparators.

The staff of the State Museum in Windhoek was extremely cooperative in all phases of the work and several curators and technicians including the director, Mr. Neels Coetzee (a mammalogist himself), spent time in the field with our party. Gratefully, we take this opportunity to acknowledge their assistance and many kindnesses. Thanks also are due to the Administration of the Republic of South Africa-South West Africa, Nature Conservation and Tourism Branch, for permission to carry out our research and collect specimens.

THE LAND

South West Africa sits astride the Tropic of Capricorn on the west coast of the continent of Africa. As a result of this geographical arrangement, the cold Benguella Current flowing northward from Antarctica adds little moisture to the offshore air through evaporation. Furthermore, the prevailing winds blow from the east across the broad land mass of southern Africa and have largely lost their life-giving cargo of rain clouds by the time they reach these longitudes. This situation, which finds a parallel in Pacific tropical South America, produces a very dry climate and the land has become a desert.

Actually it is more accurate to speak not of one desert but a complex of major arid habitats, all of which were visited by the expedition (see map).

Running along the coast is a 100 mile wide stretch of flat, gravelly plains and sand dunes. Some of these dunes reach elevations of a thousand feet and are, therefore, among the highest in the world. Perhaps the most extreme desert in the world, this strip constitutes the famous Namib Desert.

The great sea of red sand, the Kalahari Desert of central south Africa, overlaps thousands of square miles of the eastern portion of South West Africa. It rains a good deal more here, especially in the north, than on the Namib, but the moisture sinks deeply into the sand, which thus supports only a modest cover of grassy and scrubby vegetation (steppe). No surface water, however, is to be found, so the land is no place for the thirsty. Much of this expanse consists of series of parallel dunes, 100-500 feet apart, rolling over the landscape like ocean waves. Endlessly, another and yet another dune meets you as you climb over the crests and traverse the depressions (called "streets") between.

The Namib and Kalahari Deserts, where frost often occurs, share the characteristic of long cold periods. Although both can be searing in the summer, average yearly temperatures run slightly

cooler than in the Sahara and other tropical deserts. For this reason, geographers refer to them as "cool deserts."

The land between these two deserts is a broken high plateau, the rocky backbone of South West Africa. Here, the thorny shrubs or "Wait-a-Minute! bushes" cover the steep slopes with a mantle of hard, woody, impenetrable growth, somewhat similar to our chaparral, but with thorns. Try to push your way through this vegetation and you are immediately ensnared in the ruthless arms of an octopus with spine-studded tentacles.

Situated in a sheltered corner of the Aus and Eros Mountains at an elevation of 5500 feet is Windhoek, the administrative seat of the territory. With a population of only 36,000, this city is one of the smallest capitals of any country. Strictly speaking, South West Africa is not an autonomous state, but rather a country in limbo, still officially under the control of a United Nations mandate, although administered *pro tempore* by the government of South Africa.

The central plateau gives way in the northeast to a vast, monotonous plain covered with a lush but still thorny shrubland. Small, soft-leaved trees begin to appear north of latitude 20° (Mopane forest), and the countryside begins to look less like a desert.

Cutting sharp rifts in the central plateau and the bordering deserts are river gorges which are filled with rushing torrents during the height of the rains. They all run dry in the summer; only a marginal vegetation of acacias, tamarisk and bamboo and occasional game wells give evidence of an underground store of water.

This, then, is the physical character of the land the expedition met and traversed. We had decided that the best time of the year to learn the most about the fauna from a scientific aspect was the beginning of the rainy season. Hence, we planned the two months of field work for October and November, when the first rains customarily come. These are the "little rains," followed in December and January by heavy downpours that make road conditions unreliable, a time we preferred to avoid. The earlier months also permitted us a view of the effects of the long, dry season and to profit from the explosions of animal life which normally attend springtime in deserts.

Unfortunately, the rains of 1972 were late in coming, and the scattered thunderstorms which did form seemed always to avoid our skies. The only exception was the heavy downpour of November 22 which rewarded us with a few days of frantic animal activity, especially among the cold blooded reptiles and insects.

FIRST CAMP—BARBY

The night of September 30 was a night of trial for Basie and Ria Maartens. They were faced with the task of finding a place for our mountain of equipment and major items of camp gear on their newly purchased six-ton lorry.

By some miracle, the following morning found us ready to depart, the truck looking like a monstrous mechanized pack mule overburdened with boxes, tents, poles and paraphernalia, with several of our native helpers clinging to the top.

By early next morning, after a 400 mile journey south from Windhoek, we arrived at a farm called Barby. Barby is located approximately 60 miles southwest of Helmeringhausen, near the edge of a small eastward projecting finger of the Namib Desert. The locality was chosen because of its proximity to the Namib and for the availability of several other habitat types nearby. Our camp was set up along a dry stream bed in a small canyon near the farmhouse.

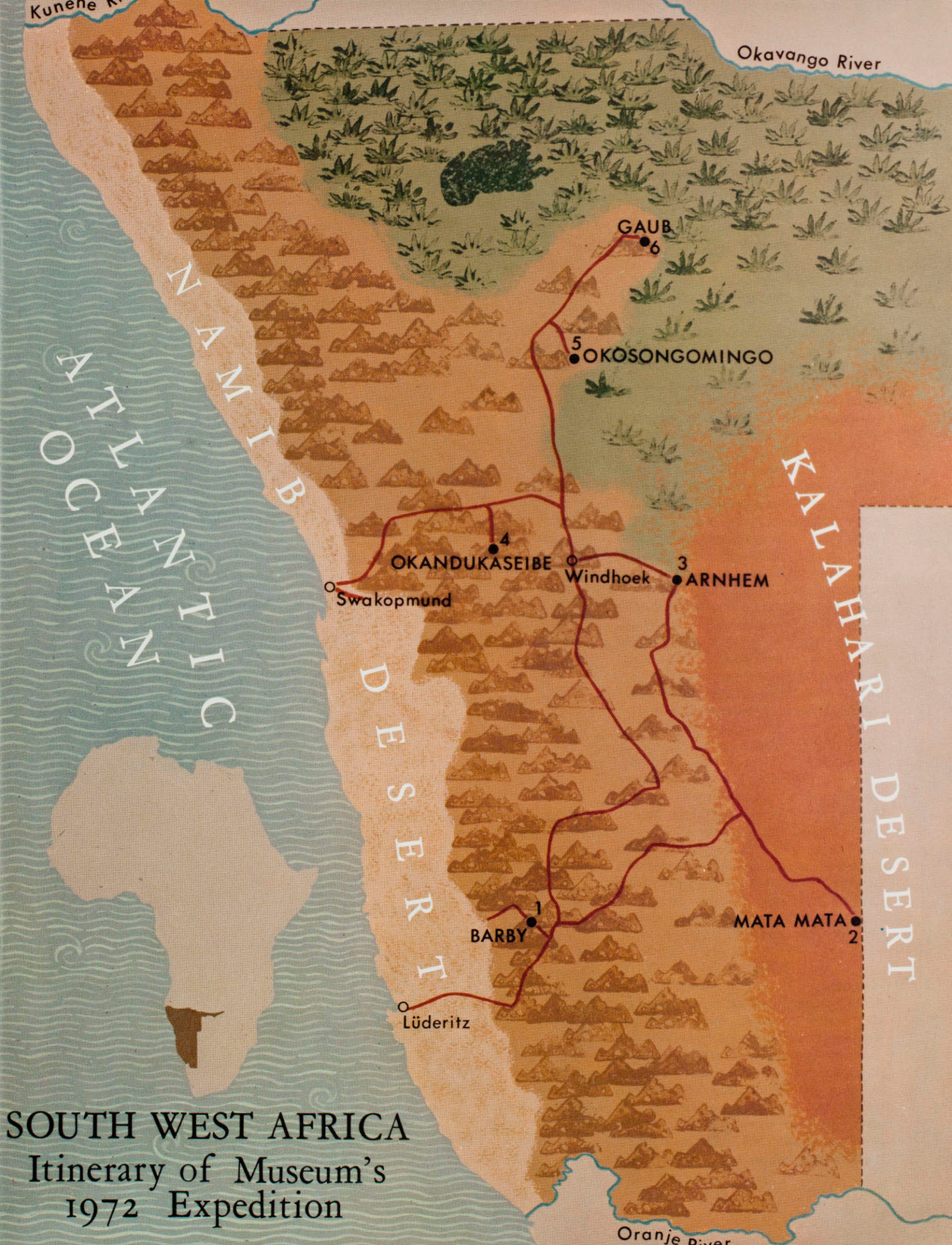
This is where we had our first taste of South West Africa in the wild and our collecting began in fury. Lester, particularly, found rodent life so prolific (*"Rhabdomys* are even running around all over the place in the middle of the day; neat!") that he shortly became lost in heaps of specimens, all needing attention. Maggie manned (rather "womanned") the Rapidograph pen, spring scales and notebook, and within a week scores of specimens had already been added to the Museum's collection. Trapping success at Barby and environs far exceeded that of the other camps.

Bezy was no less happy than Lester at his finds. A big surprise was a five foot long Monitor Lizard *(Varanus)* that one of the farm boys brought in. As a reward for this prize, the captor received three Rands (about $4 U.S.). Bezy had provided himself, before coming out into the field, with a bag full of coins of small denominations just for the purpose of enticing local farm hands and curious boys to bring him critters. The techniques met with success, and several important specimens were acquired this way. We all profited by this system later in the trip. At our last camp, Hogue found out that a bag of live scorpions was valued less than a lizard but worth much more in excitement.

Several evenings were spent in exploring the dunes at the edge of the Namib. Lester was seeking the Namib Golden Mole *(Eremitalpa granti namibensis)*, a recently discovered subspecies that lithely swims through the sand and is so secretive that its existence was not known until 1959. Unfortunately, none were captured, although there was abundant evidence of their runs on the surface of the dunes. Here Bezy found *Palmetogecko*, a yellow-eyed gecko that prowls the dunes at night, protecting its sensitive pale pink skin from the sun. Webbed feet, a structural peculiarity found in only one other lizard, aids its movements over the soft sands.

The nights on the dunes yielded some of South West Africa's beetle wonders to Hogue. One family especially, the Darkling Beetles (Tenebrionidae), have developed in amazing variety in these deserts. The great age and geographic isolation of this part of the world have given evolution abundant time and opportunity to produce every imaginable form the beetle body can assume. Most of the adaptations are related to the stresses of dryness and heat, and thus we found species with stilt legs on which their bodies are supported high off the hot sand, others with inflated wing covers, the dead air space beneath providing them with a natural insulation and still others flat and saucer shaped to enable them to dig easily into the sand and hide from the heat. Paradoxically, most are darkly pigmented, which should adversely raise their body temperatures since black absorbs the sun's heat rays instead of reflecting them. However, most are active only at night or are protected by the air insulation mentioned above.

Many species live on shifting dunes devoid of any vegetation whatever. Such an inhospitable habitat can support a beetle fauna of scavengers only. These beetles run over the concave lee face of the dune on the windiest days searching for bits of carrion or dead animal debris blown out of or across the dune. Hogue collected a number of specimens from a dune which was methodically marching across the highway near Luderitz. In company with some of the staff of the State Museum, Maggie, Bezy and Hogue made the side trip on October 5 to this old fishing port, collecting in the famous diamond reserves (with special permission, of course). Luderitz was the first German settlement in the territory



SOUTH WEST AFRICA
Itinerary of Museum's 1972 Expedition

and was the small beginning of the once-gigantic German Empire. It gets its name from Adolf Luderitz, a Hamburg merchant who began trading operations there and persuaded Chancellor Bismarck to place the territory of South West Africa under German protection in 1883. It was near here in 1908 that diamonds were first discovered. The coast near Luderitz also marks the approximate northern extreme of kelp on the southwest African coast. The beds around Shark Island (in the Luderitz harbor) are extremely lush, no doubt like those off our Southern California shores were before man's depredations.

Crossing the desolate terrain on our way back to camp at Barby Farm, we reflected on the strangeness of so many sights we had seen. Maybe because it was where we had first been exposed to the unusual nature of this dry corner of Africa, but it seemed that here there were more oddities than we should expect: *Perambulating sand dunes* that are more like giant terrestrial amoebae than mere piles of inanimate sand grains. Their pseudopodia have even captured the once thriving center of the diamond industry, Kolmanscop, so that few buildings remain unengulfed by the white sand drifts. *Parrots,* those symbols of tropical luxuriance, flying in flocks through the harsh vegetation surrounding the camp. The Rosy-faced Lovebird was as common here as any of its relatives in the green forests of equatorial Africa. *Living stones.* Almost as if, in a fit of frustration over the difficulties of sustaining life here in this dry, hot land, Mother Nature turned some of the lifeless stones to organic beings. With wavering trust in our senses, we watched a smaller rust-red sandstone pebble resting on a larger rock sprout legs and walk away, a stone locust *(Trachypetrella)* making its lumbering escape. We touched another smooth, cleft rock and found it cool and soft in the sun, not a rock at all but a succulent plant not yet in flower (a Stoneface, *Lithops).*

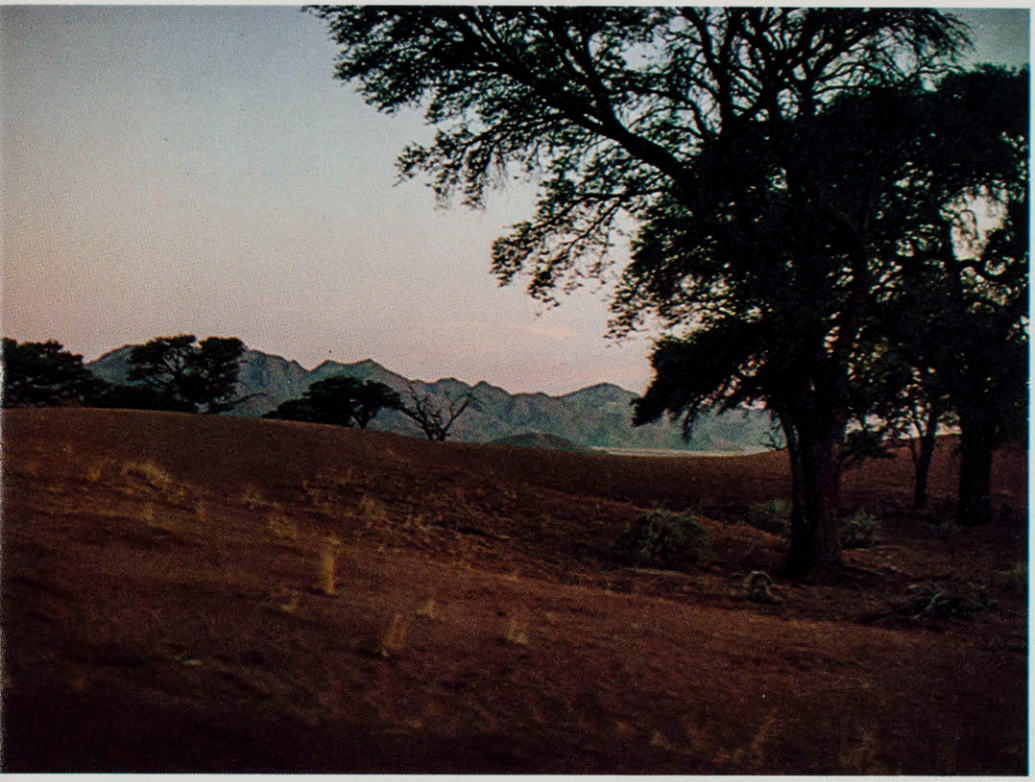
Nest of the Sociable Weaver (*Philetairus socius*). These giant communal nests may be occupied by dozens of bird families. They are also a favored haunt of cobras. (Photo by J. Northern)

A group of Gemsbok (*Oryx gazella*) cooling off in the shade of an acacia tree. The insidious "Tampan" (a tick-*Ornithodorus*) waits in the soil of such places to climb the legs and parasitize unwary animals. (Photo by L. Lester)

The "prep tent" was the center of activity each day. Our skinners are busy preparing bird and mammal skins. The refrigerator was used to keep specimens from spoiling until they could be attended to.

MATA MATA

On October 11, we left Barby for the totally new world of the Kalahari Desert. Our second camp was set in the depression between two parallel sand dunes through which flows the Auob River in flood season. Here we were situated on a farm called Welverdiend (World's End) where Karakul sheep grazed and provided the chief source of income to the rancher. The tightly curled, glossy, black coat of the newborn lambs of this breed



Vista of the Kalahari. The undulating red sand dunes are sparsely vegetated with Camel Thorn Acacias and clump grasses.
(Photo by L. Lester)

Mammal study skins must be pinned out to dry so legs and tail will remain in the desired position. This was one of Maggie Taylor's endless jobs.
(Photo by J. Northern)

are highly valued by furriers in Europe and the U.S. We had seen large herds on many farms we passed and often noted a pair of goats mingling with the sheep. We learned that since the sheep are too dumb to come back to the corral at night, the intellectually superior goat, which has at least enough sense to find its way home, leads the herd to safety and water at the end of each day. White or black-and-white goats are preferred for this post since they are easily seen in a herd of black animals. One enterprising farmer, lacking a suitably marked animal, painted white stripes on his black goats to equip them appropriately for their job.

We called this camp Mata Mata because it was located just a mile west of the headquarters of the Kalahari-Gemsbok National Park, a remote outpost with that name. Wedged between South West Africa and Botswana, the park is almost a million hectares of undulating brick-red sand dunes incised by the dry river beds of the Auob and Nossob. The latter are studded with large Camel Thorn Acacia trees and, while we were there, a dense growth of wild flowers stimulated to bloom by a recent trace of rain. Large herds of Gemsbok, Springbok, Blue Gnu, Eland and other game roam the park. Among many animals of this arid region, Gemsbok and Springbok can survive long periods without water. During times of drought, they use their sharply pointed hooves to dig out the bulbous plants which are eaten mainly for their water content.

Many other mammals of the Kalahari solve the problems of heat and dryness by staying in burrows during the day and restricting their foraging activities to the night. Such is true of the Springhare which is common in the region but was seen only after dark, hopping along the roads in the lights of the Land Rovers, like midget kangaroos. These animals are analogs of other desert jumping rodents, including our own kangaroo rats and Australia's true marsupial hare wallabies. Maggie, Lester, Ward and some of the museum visitors went on a "Springhare roundup" one evening to collect live specimens for chromosome studies. Several animals were confused by the headlights and were caught by hand after a lively chase.

Through the courtesy of South Africa's National Parks Board of Trustees, we were permitted to collect limited numbers of selected animals inside the park boundaries. The area proved to be a source of many species of birds sought

by Northern and a source of some unexpected excitement one day to him, Hogue and a park ranger. Northern had shot a Wattled Starling in a large camel thorn tree. As so often happened, the falling body became lodged out of reach on a thorn-studded branch. For several minutes, the three of us threw sticks at the bird, hoping to dislodge it, when a low growl became audible from behind the tree. Simultaneously, each of us spotted a large male, black maned lion resting in the shade; he had been watching our antics the whole time. We lost no time tracking to the Land Rover. Certainly we had nothing to fear from this sleepy old soul, but we then discovered a pair of lionesses with cubs a short distance behind him who may have paid us more attention.

For Bezy, this camp represented one of the finest and most diverse selections of reptiles, especially lacertid lizards, he had ever seen. His interest in this group was heightened when he noted that the many species exhibited a unique sensitivity for subtle variations in the type of soil upon which they lived. Slight differences in soil type seemed to be paralleled by a change in species. He hopes that his collection of lizard specimens and samples of their chromosomes may shed light on the question of these species' relationships and how they have successfully remained distinct.

Bezy collected and prepared a large number of tissue samples from the reptiles he encountered for study of their chromosomes. By carefully removing bone marrow and portions of other organs, concentrating the cells by centrifugation, and spreading them on microscope slides to be stained later, the configuration and number of chromosomes in their nuclei can be seen and studied. This science of karyology is extensively used by many taxonomists to give them added insight into species relationships and evolution.

A charming herpetological aspect of this camp was each evening's gecko concert. About dusk, the Barking Gecko *(Ptenopus)* begins a chirping chorus that lasts until eight or nine o'clock. This lizard is strongly territorial, and its voice is thought to signal other individuals to stay away from its home ground. Both males and females call from small burrows in the sandy soil.

Yet another reptile, with considerably less appeal than the little geckos, made its presence known one afternoon. One of the native crew noticed some irregular marks in the sand in front of the dining tent and recognized them as the tracks of a cobra. The tracks disappeared at the base of one of the Camel Thorn trees shading the end of the tent. The snake had obviously climbed the tree. Bezy was informed, and plans were immediately laid for the cobra's capture. But the situation proved literally to be a thornier one than anticipated. The snake was obstinately lodged in the very top of the tree, and no amount of coaxing with long sticks would bring it down. Bezy finally climbed into the tree to secure a better vantage point from which to tease the serpent out of the branches. The snake held fast, seeming to know that the thousand sharp spines of the tree would deter any aggressor—that they did, as Bezy's vituperations revealed. But by persistence, he finally forced the snake to move—but look out— it chose to race right down the trunk into Bezy's face, and Bob bailed out.

A little later, he and Basie Maartens managed to extract a healthy, five foot, sleek yellow Cape Cobra from the tree and drop it on the ground in the midst of the whole camp personnel, who by now had all gathered to watch and take part in the fun. This specimen now holds an honored place in the museum's collection, alongside five others also taken in the immediate vicinity of the camp, one from a second tree also shading the dining tent.

As with the dunes of the Namib, the Kalahari sand hills hold a rich treasure of highly adapted life forms. Possibly the most extreme is the Legless Skink *(Typhlosaurus)*. These worm-shaped lizards have lost all external traces of legs, have scales especially to protect their eyes, and swim through the soft sand almost as effortlessly as a pond snake through the water. They seem to be attracted to the hummocks around the roots of the stiff clump grasses that grow on the dunes, probably because of the moisture that the plants hold and to feed on the insects which are also prevalent there.

As we left Mata Mata on October 22, we all agreed we had tasted only a small morsel of the fabulous Kalahari, but enough to realize why it has attracted adventurers. We were happy to leave behind only the pesky "Gemsbok Fly" (a large member of the flesh fly family) which tried to drive us mad with its continual glue-footed explorations of our faces, ears, necks and noses.

ARNHEM

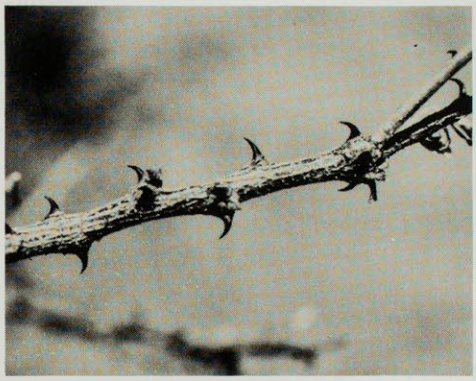
Our next camp was set up on a farm called Arnhem in surroundings totally unlike those of the previous sites. Here we were immersed in a dense thicket of large, very thorny shrubs, through which we could see out only by looking straight up. As with almost everywhere in our travels, the thorniness of the vegetation made collecting of all kinds of animals extra difficult. Birds that were shot always caught in the tops of the trees. Lizards and butterflies instinctively know that the safest place for them in the event of danger is the interior of the nearest bush with spines. Hogue found that the only way to collect the very large grasshoppers, which always chose to perch in a thornbush, was to shoot them. By carefully gauging distance and using fine dust shot in a .22 caliber revolver, a good series of undamaged specimens were bagged, most individuals with only a small hole or two in the body.

Although working in the thickets yielded material of interest to all of us, the real attraction of Arnhem and the principal reason for including this farm on our itinerary was the existence of a large cave on the property. It has no name but is well known to South West African biologists. The cave was discovered and originally explored by the farm's first owner, whose son told us that it extends underground for many miles, and this his grandfather had once made a three day journey into its depths without reaching the end.

Caves emit a magnetic attraction for many people and particularly for one odd kind of zoologist, the chiropterologist (bat specialist). Our bat man, Lester, listened skeptically to the farmer who told of a giant bat having been seen in the cave, . . . "so large that it couldn't be held by the wingtips by a man with outstretched hands without letting the body droop down." "It can't be," said Lester, "but let's go look anyway." And a spelunking trip was planned for the next day.

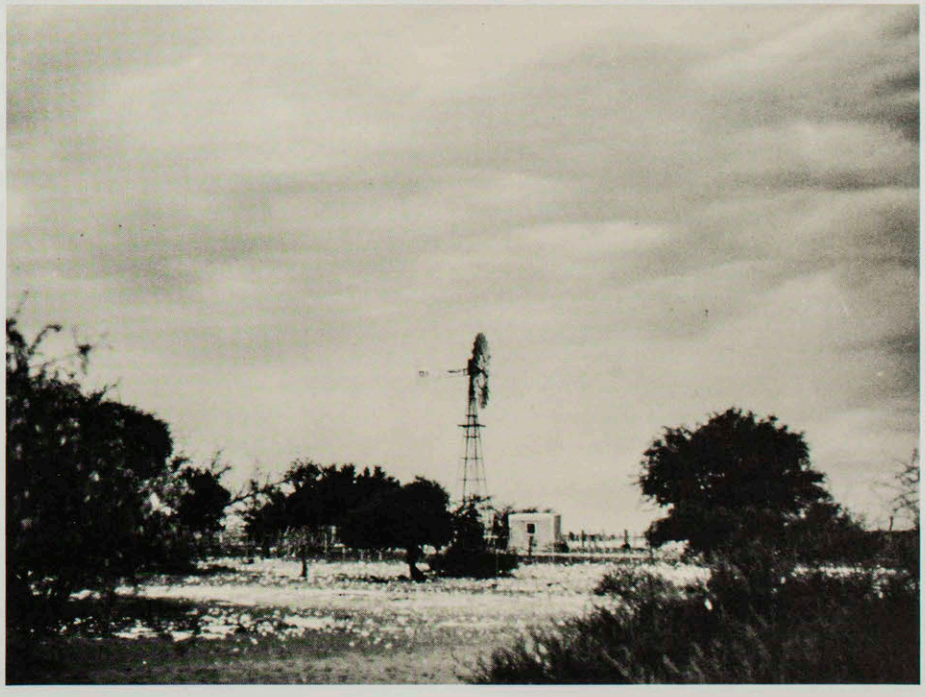
The fun began even as we entered the cave. The entrance was guarded by several colonies of nesting paper wasps which resented our presence. They charged us aggressively and Lester was stung. With the help of a bee bonnet fashioned from Hogue's insect net, and leather gloves, Maggie made it through unscathed. The rest of us luckily avoided the wasps, and we all found ourselves in a very large steeply sloping cavern which led to a series of deeper rooms. The floor of the cave was covered with several inches of powdery dust which we kicked up with our feet, filling the air (and

One of the sand dune creatures is *Palmatogecko*. Its webbed feet help it to run on loose sand and its huge eyes are adapted to night vision.



A formidable obstacle to foot travel through South West Africa's shrub country is the branch of the "Wait-a-minute" bush (*Acacia* sp.), always ready to snare you.

Basie Maarten's 6-ton lorry carried half of our staff and most of our equipment. It took all morning to load before moving to a new camp.



Wind-driven pumps spring from the landscape everywhere to underscore the extreme aridity of South West Africa. (Photo by L. Lester)

our lungs) with the debris of ages of bat droppings, decaying bodies of long dead cave animals and finely ground soil. Soon we came to a room inhabited by thousands of very lively confused bats. Many collided with us as more and more dropped from their ceiling roosts and flew by, swishing, squeaking and screeching.

All this made Lester ecstatically happy, and he succeeded in taking several species of bats. One, the Horseshoe-Nosed Bat *(Hipposideros commersoni)* was previously known only from an area hundreds of miles to the north. Hogue scooped up an overflowing bottle of Spider Beetles (Ptinidae) from the quintillion or so he found feeding on the dry organic deposits on the cave floor. After a few hours of exploring the cave, we emerged satiated with our finds (though no giant bat had materialized) and the adventure that all caves seem to hold. A final breathtaking scene from within the cave was the silouette of a Barn Owl against the glaring orb of the entrance, flying in to take up a perch on a wooden post only a few feet from our eyes.

OKANDUKASEIBE

The Maartens had recently purchased a sizable farm west of Windhoek which boasted a variety of animal life that made it easy to accept their invitation to spend some time there. On October 30 we set up our fourth camp on the dry sandy bank of the Swakop River in a grove of immense Annabooms (another thorn tree—*Acacia albida*—which grows to heights of 100 feet or more and has trunk diameters far greater than any other South West African tree except the Baobab). Most of the year the Swakop is a dry bed like all other large rivers within the territory. But at the height of the rainy season, veritable walls of water plunge through the gorges of their tributaries, and a raging current runs wide and free down their courses.

Evidence of big game immediately caught our eyes as we strode out into the river bed. Kudu instinctively know that a reservoir of water is available beneath the sand, and they dig deep holes with their forelegs to reach it. We saw several of these wells near our camp and the hoof prints of Kudu, Springbok, Gemsbok and Steinbok. We saw the animals themselves in the canyons and on the nearby hills along with Klipspringer and the rare Mountain Zebra.

Lester's attention fell scantly to these, passing more intently to the smaller mammal forms which inhabited the farm. He took several specimens of the Rock Dassie, an animal resembling a Guinea Pig whose closest relative, curiously, is the elephant. Their hind toes are modified in an unusual way, only the first digit bearing a claw for grooming. The skin of the remaining toes and bottom of the foot is very thick and rubbery, like the sole of a tennis shoe, giving the animal traction when scurrying over the smooth rock outcroppings on which it lives. Elephant Shrews, so called because of their very long, dexterous noses, were also abundant. In the rocky outskirts of the hills, we often saw them hopping about like springhares from place to place during the day, grubbing about for insects with their proboscises.

While most of the farm's mammals preferred the rocky highlands, the bird life clung to the margins of the river where the vegetation was most dense and varied. A most startling experience awaited the first of us to come near a pair of Grey Louries or "Go-Away Birds," large grey turacos common near camp. Off by oneself, not aware of any human presence nearby, it causes a near panic reaction to hear a voice from the trees exclaiming, "Go away, go away." This is the call of the turaco, and the mime of a raspy human voice is perfect.

There were many other birds which formed Northern's opinion that this was the best camp, ornithologically. Some species occurred in great flocks: Violet-eared Waxbills, Red-headed Amandinas and Sandgrouse. Guinea Fowl were common; the Pied Babbler, White-headed Shrike, Honeyguide, and Red-billed Wood Hoopoe were rare birds collected.

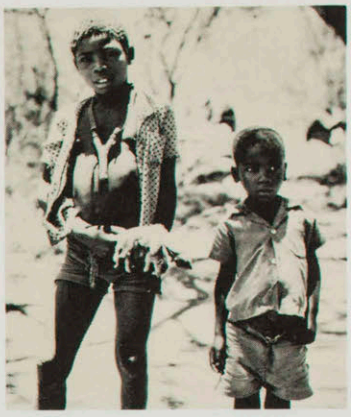
From Hogue's and Bezy's points of view, the reptile and insect life was equally fascinating. Termites were especially abundant on the farm and first made their presence known one night in a bizarre manner. Hogue and Bezy were climbing up the side of the hill opposite the camp with lanterns in search of scorpions and geckos. With each step, a low papery rustling sound became audible at our feet and we wondered at the source of this eery noise. A little investigation showed that we were walking on a network of termite tubes ramifying over the surface of the ground. The disturbed termites were banging their heads on the dry, resonant walls of the tubes in an apparent effort to drive us away.

Giant termite mounds *(Macrotermes mossambicus)* studded the landscape wherever we looked. One morning we tried to excavate a mound with very little success. Even with the help of a pick, shovel and cable-noose pulled by a Land Rover, we succeeded in opening only the top so that we could barely see inside. The walls of these magnificent works of insect architecture are made of bits of soil glued together with the saliva of the tiny builders and are nearly as hard as concrete. This seems to pose no problem for the Aardvark, however; its fore claws are adapted to the job, and the beast easily burrows straight to the heart of the mound where it finds its prey in abundance.

Because of our relative proximity to the coast, we took the opportunity for another side trip. Our objective this time was to sample the sand dunes near Swakopmund and visit the nearby Namib Desert Park for a look at the famous Welwitschia plant. According to botanical legend, the discoverer of the latter, Friedrich Welwitsch, was so overcome by the strange spectacle of the singular looking plant that he knelt down reverently in the sand beside it and could only stare, afraid to touch the plant lest it prove to be a desert mirage. The plant has a huge tuberous root (diameters reaching three feet) and two leathery, green, strap-shaped leaves that trail along the ground until worn off by continual abrasion against the desert pavement. Specimens may live more than a hundred years and are the only plants, aside from a few annuals that germinate after the infrequent rains, that grow in this extreme desert region. We were able to observe and film this botanical wonder and Hogue found a species of true bug *(Probergrothius sexpunctatus)* living on it. The nymphs are bright red, no doubt a color warning of a bad taste, and the adults are handsomely yellow and brown spotted. In spite of some conjecture that it pollinates the plant, we guessed that this was not the case since the bug possesses piercing mouthparts, adapting it for sap sucking rather than flower visiting. Another extraordinary feature of the plant (not a true flowering plant—but a gymnosperm related more closely to Turpentine Broom and cone-bearing trees) is a flower which exudes a sugary substance and which may attract another kind of insect to effect pollination.

The sand dunes yielded some fascinating finds. Bezy, Lester and Maggie spent two thrill-filled nights tramping over the dunes in search of *Fitzimmonsia,* a second form of legless lizard, larger and less specialized than *Typhlosaurus,* in which minute projections at

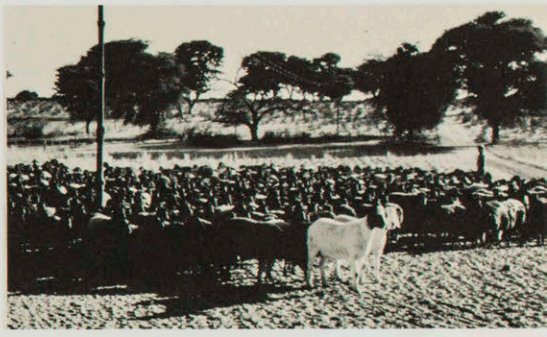
An elephant shrew (*Elephantulus*). Fairly abundant at Okandukaseibe



Two of our "acquired" collectors. The boy at left was deadly accurate with his slingshot as his offerings of tree squirrels (*Paraxerus*) demonstrate. (Photo by J. Northern)

One of South West Africa's "living stones", the grasshopper *Tachypetrella*. Cryptically colored and shaped to mimic the red rocks on which it rests, the species is invisible until it moves.

A herd of Karakul sheep on a farm near Mata Mata, with its "leader" goats at attention dutifully in front.



the base of the tail remain as evolutionary vestiges of their legged ancestry. They met with some success in spite of the sandblasting they took and came up with a Sand Viper *(Bitis peringueyi)* to make a pair with the one Hogue caught one afternoon with his butterfly net. These African equivalents of our sidewinders hide just below the surface of the sand, with only eyes and tongue protruding, awaiting the approach of prey. When aroused, they boil out of the sand and aggressively pursue any adversary, including surprised entomologists.

Maggie will long remember the beach at Swakopmund. This is where she lost so many fingernails helping Hogue turn a thousand beach boulders in search of an elusive little black gnat (clunionine midge) which occupies the intertidal zone. After two afternoons of searching, a series was collected and is now being studied by a specialist in Japan.

OKOSONGOMINGO

A few more days were spent at Okandukaseibe after returning from the coast and then we moved to Camp Five, Okosongomingo, a farm near a complex of mesas called the Waterberg rising out of the thorn scrub plains near Otjiwarongo. The physical site on which we camped was something less than picturesque, a corral from which the cattle had been temporarily evicted but still with remembrances of their presence, but with a good water supply and easy access to the mountains. "Waterberg" is Afrikaans literally meaning *water mountain* in reference to the many springs issuing from near the rims of the three major massifs.

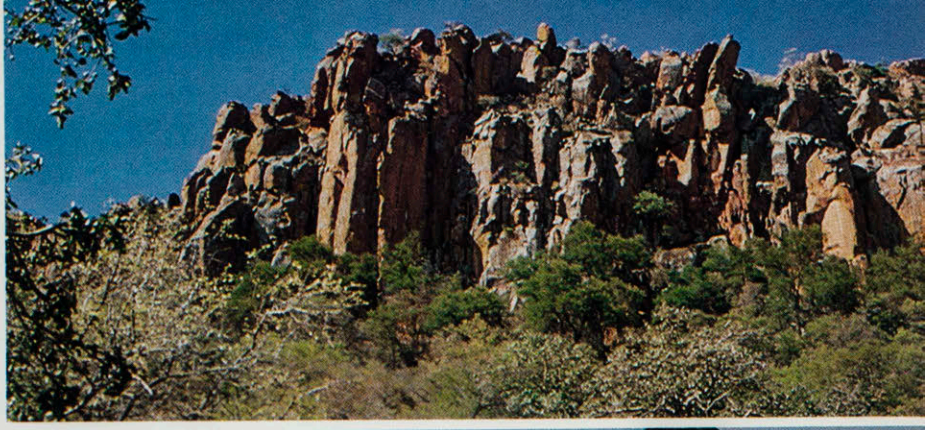
The geological structure of the mountains is uniquely suited to water storage and springs. Since the mountains are flat-topped, rainwater does not flow off but accumulates on the summits and gradually seeps into the uppermost porous sandstone stratum to a depth of approximately 100 feet where it encounters a relatively impervious layer of rock. The underground water there spreads laterally until it emerges in a series of springs ringing the mountain like diamonds on a necklace.

The springs are literally jewels of nature, oases of life in the midst of the parched plains. Logically, most of our efforts in this area were concentrated on the springs. Both plants (such as fig trees) and animals (in particular the galago and *Charaxes* butterflies) belonging to tropical groups which were once probably widespread over the entire area, are now surviving as vestiges around these wet places. Further evidence of the more humid nature of these pinpoints of verdure is the existence of true soil (with humus and some evidence of horizons), found nowhere else in South West Africa.

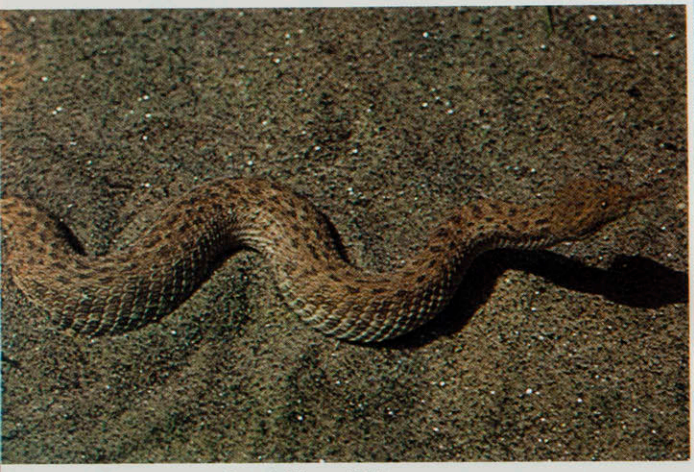
Bezy and Lester spent two nights at Okumuru Spring on the south side of the largest mountain. The first night held a harrowing experience for Bezy who was somewhat nervous about leopards and the large pack of baboons living near the spring and which seemed disdainful of being intruded upon. Late in the night, Bezy started from his fretful dreams of simian monsters to have his greatest fears realized, for there hovering near him was the largest and most fearsome creature he had ever seen—and it seemed about to attack. Fortunately, Lester spoke just in time to avoid being pummelled with rocks—he had only wanted to get a drink of water and had stumbled over Bezy and awakened him.

GAUB

Moving north from Okosongomingo, we settled into our last camp on November 20 in a grove of thorn trees beside an old farm house, once a Rhenish



The patch of contrasting green vegetation marks the location of Okumuru Spring at the base of the Waterberg Mountain escarpment.

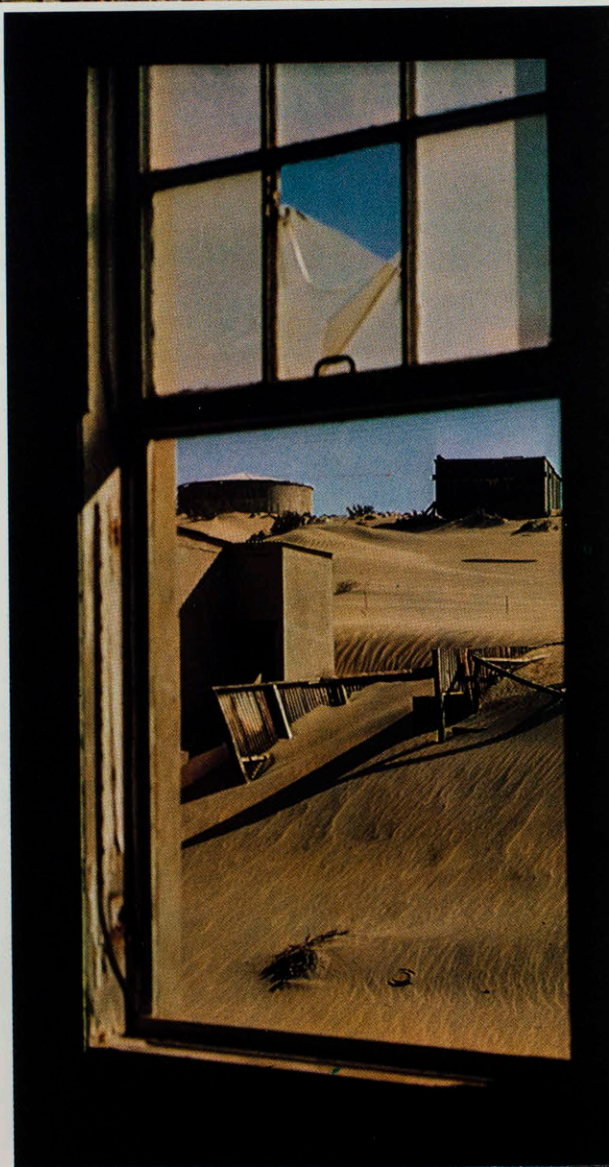


The Namib Sand Viper (*Bitis peringueyi*) in the process of wriggling himself beneath the surface of a dune. Only bulbous eyes and a snout will finally remain exposed.

Hogue examining a mature specimen, perhaps over 100 years old, of *Welwitschia mirabilis*, a botanical curiosity of the driest parts of the Namib Desert. (Photo by B. Maartens)

Local and Museum members of the 1972 Expedition to South West Africa. Front row (left to right): J. Northern, C. Hogue, B. Maartens, M. Taylor, R. Maartens, L. Lester and R. Bezy. Native crew in rear; C. Ward (red kerchief, standing center).

The blowing dunes of the Namib are slowly burying the old diamond mining center of Kolmanscop.



Mission. The farm is now known as Gaub.

The gardens of the old mission were still intact and in the flowers and fruit trees we found relief from the monotonous thorn scrub surrounding our previous camps. The natural vegetation of the area was also different, a mountain savanna, greener and lusher and with respectably-sized trees with soft foliage.

It was in this habitat that Bezy found, perhaps, the most interesting lizard of all, *Icnotropis,* a member of the family Lacertidae. They were first seen the day following the only real rain of the entire trip. A heavy downpour thoroughly soaked the sandy soil and stimulated to activity all life in the area. For example, the rain was a signal to termites to emerge and millions of winged sexual forms almost buried Hogue's moth light.

Bezy's small lizards also emerged, and he was able to capture several. Too small to noose, and too delicate to zap with rubber bands, they had to be caught by hand, a task which proved difficult since they rarely exposed themselves, preferring to hide in thick clumps of sharp, stiff grass. All specimens caught turned out to be juveniles; adults are found only later in the year. This fact is a result of the life cycle of *Icnotropis* which is uniquely annual, unlike any other lizard. The eggs hatch during the summer rains. The young grow and mature by summer and deposit their eggs and die. The drought resistant eggs pass the dry fall and winter seasons to hatch for a new generation the following year.

Some people living on the farm brought a mother galago ("bush baby") and her baby into camp one day. The mother was injured in a fall from a tree and behaved so distressfully that Lester felt it best not to release her but keep the family for a few days to check the seriousness of the injury. The large, wistful eyes of the mother instantly cut through Maggie's shell and stirred her motherly instinct. The galagos became her private charges for the next few days, living on handfuls of moths, spared from Hogue's light traps, and heaps of affection from Maggie. The pair was finally released and no doubt now is living in the forest with vague memories of a peculiar encounter with strange, two-legged creatures who lived in green canvas boxes and poked beetles into envelopes instead of eating them.

There was also a cave on Gaub Farm, not as large as that on Arnhem, but no less fascinating. Here the caverns and rooms were small and accessible only by extremely narrow and tortuous passageways through which we often had to squirm and crawl on our stomachs. This aroused latent claustrophobic feelings in all of us except Lester, who was too intent on finding bats, and our guide, the farm caretaker, who seemed to delight in leading us deeper and deeper into the most remote recesses of the cave. He especially enjoyed a few moments when we extinguished all our lights; we could see only his cigarette, burning brighter each time he drew a breath to chuckle to himself. Hogue's constant proclamations that there were no bats in the cave went unheeded.

Lester took only three bats but was much more successful with his nets at a nearby pond (one of the few natural flatland springs, or "fountains" as they are called, in the territory). He collected 12 of a rare Flat-headed Bat *(Sauromys)* known previously only from three specimens in other North American museums.

RESULTS

It will be years before the total results of the expedition will be known. The distributions of many birds will be better understood from the 720 specimens taken by Northern. These add to the Museum's collection one new genus, 35-40 new species and 70-80 new subspecies. Bezy has accessioned over 900 reptiles and amphibians (frogs and toads only) from the trip with an associated 600 microscope slides holding samples of tissues from which their chromosome structure can be ultimately studied. The number of insect specimens taken by Hogue number over 20 thousand and greatly augment the Entomology Section's representation of desert adapted forms. Many unnamed species are sure to be found among this assemblage. Around 2100 mammal skins and skeletal materials and chromosomal slides, from shrews to Mountain Zebra, were the fruits of Lester's efforts.

Apart from the direct benefits to science of the addition of so much material to the world's store of animal knowledge, a plus factor of inestimable value were the personal contacts and friendships established between like-minded men half the world apart. The State Museum in Windhoek donated an additional 125 study skins of protected or especially rare birds to our Museum. Lester developed a strong interest in the desert rodent fauna of South West Africa and is already making plans for further trips and more work in the area.

All of this was made possible by Maggie Taylor. Not only her sponsorship, but the amount of physical work she accomplished, labeling, cataloguing, pinning bats, cranking the centrifuge, nursing sick galagos, and a thousand other tasks, enabled the scientists to meet their goals in the field. Thanks to her and our new friends in South West Africa, names like Grootfontein, Okahanja, Namib and Kaokoveld will always inspire images in our minds of a fabulously beautiful and biologically wealthy land that brought to us so much treasure and enlightenment.

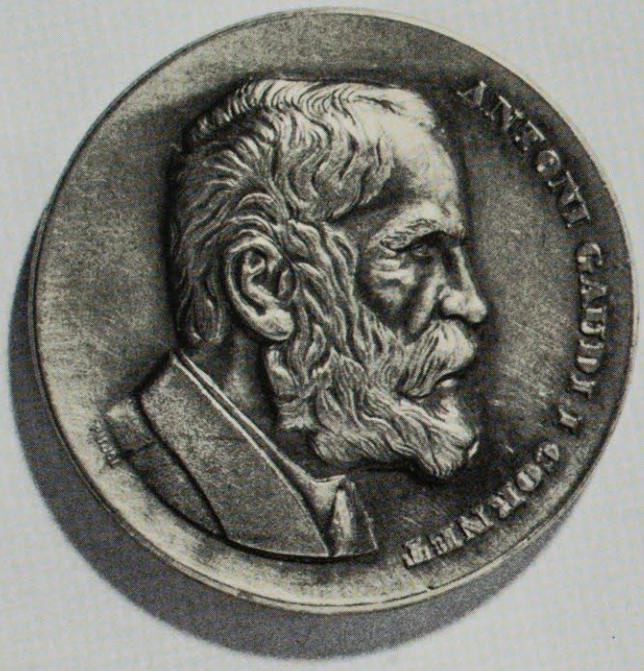
ACKNOWLEDGMENTS

In addition to those acknowledged above, we wish to thank the following individuals for their courtesies and personal assistance: stateside, M. A. Machris; staff of State Museum, Windhoek—C. G. Coetzee (Director), Pieter G. Buys, Marie-Loo Penrith, Mike J. Penrith, Barbara A. Harding, Ian Balt, Hermanus C. Strauss; farm owners and managers—L. M. Campbell (Barby), J. A. Bekker (Arnhem), A. Schneider-Waterberg (Okosongomingo), E. W. Albat (Gaub); game ranger Jonan van Graan, Kalahari-Gemsbok Park. The map was rendered by Mary Butler. Photographs by the author unless noted otherwise.

Charles L. Hogue, Senior Curator of Entomology, Natural History Museum of Los Angeles County, has again pointed out to TERRA readers the enormous value of museum field trips.

Maggy's Bush Baby (or Galago)
(Photo by L. Lester)

Antonio Gaudi
Architect of Nature



by **William Emboden**

"The tree is my master!"
A. Gaudí (1852–1926)

Passionately devoted to every aspect of nature, the great Catalonian architect, Antonio Gaudí, wrought a revolution in architecture at the turn of the century that would shape every significant work to follow; and every aspect of these productions had their origins in the Catalan earth, sea, and sky. Neither color, nor sound, nor texture were eliminated from this superb output of "growths" that form the garden that is Barcelona—seeded and nourished by one man. Out of the sea shells washed ashore on the Costa Brava, from the dried and twisted seaweed there grew a form of architecture that was so bizarre and wondrous that it had no antecedents except in nature. The helical shells of molluscs became the towers of the Expiatory Church of The *Sagrada Familia,* and transformed sound and light; a man had listened to the wind, captured its song in stone and bronze and given it to the city of Barcelona so that the bronze bells would speak at different hours with the tongues of the winds. Each piece of architecture would have its own elements of life: *Casa Batlló* would be known as "the house of bones" in which the muscle and sinew of a facade barely cover the glorious skeleton; Flowers, seeds, trees, and dried leaves would form the grand *Park Güell;* foam from the crested sea, its water currents and giant kelps form the motifs of the *Casa Milà;* all of these but augmentations to the grand work of a lifetime; yet unfinished, the *Sagrada Familia.* The latter when completed will be the largest church in the world towering above St. Peter's and capable of encapsulating the entirety of St. Mark's Cathedral (Venice), being the consummate realization of the architecture of nature. Gaudí himself said that the towers were a union of gravity and light and their convoluted surfaces are reminiscent of the surfaces of fluted and carved cacti (eg. *Cereus schottii*) that scatter and reflect incident radiation. Polychromatic tiles embedded in the surfaces of the towers along with broken glass and terracotta resulted in a transcendent naturalism in which many facets of nature are into harmony.

In 1892 Gaudí accepted a commission to design a Franciscan Mission in Tangier, and in this project he became visibly obsessed with the notion of the spiraling form of many conical sea shells so that his completed sketch looked like

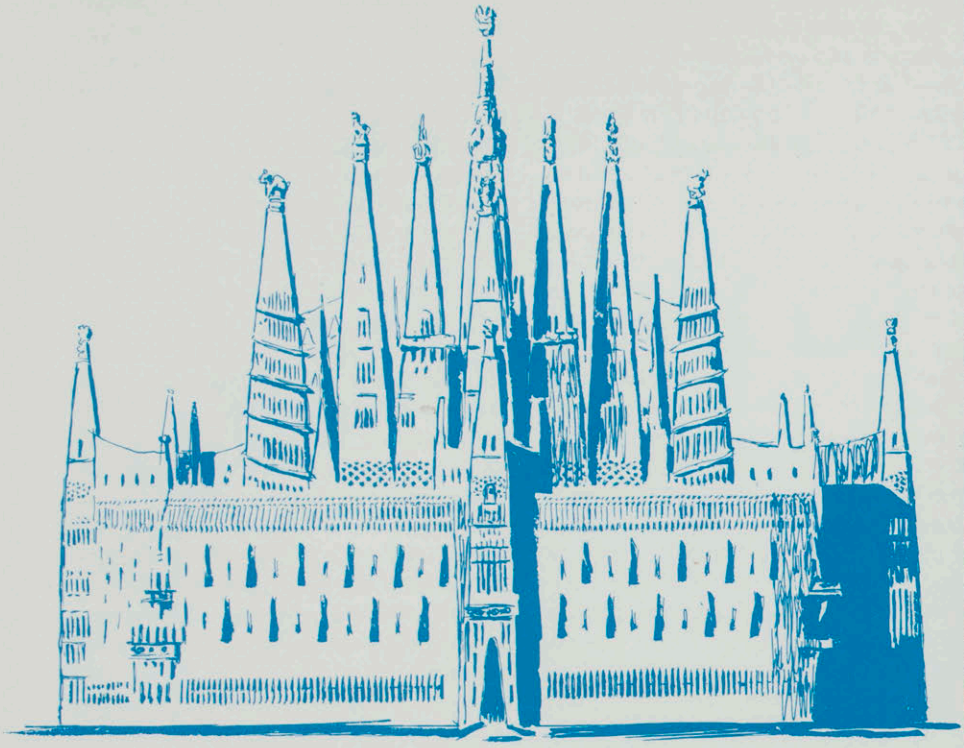
a cluster of towering molluscs—the germinal idea for what was destined to become the *Facade of the Nativity* of the *Sagrada Familia,* and the projected transept of the *Passion of Death* of the same edifice. Such spirals also obsessed Leonardo da Vinci who extended them to the foliage of his plant studies (cf. the *Ornithogalum* in the Windsor collection) and phyllotaxy. Leonardo used the motif in designing equipment for theatrical staging and staircases but his preoccupation with architecture was minimal.

Regular patterning was a concept which Gaudí regarded as aesthetically dead. To those who retaliated to this conceit by pointing to the classical regularity of the Parthenon Gaudí would caution them to look more carefully and they would find that not one column is exactly like another—by design and not accident. Architecture, like the creatures of nature, must have an inner movement and an outer movement that is in harmony, or it is dead. One must feel the energy of a building or it is lifeless.

A study of the elemental form of an egg persuaded Gaudí of its essential architectural soundness. The beauty of its form is undisputed as its structural perfection; like the seemingly fragile plant cell, an egg can withstand tremendous polar forces without breaking. Furthermore, it was a hypothesis of Gaudí that ovoid forms are acoustically the most sound and to this end he designed a university classroom which was never realized. In theory a professor would never have to raise his voice in order to be heard; he would lecture from a slightly elevated podium at the tapered end of the demi-ovoid.

Gaudí led a modest life devoted entirely to creating his personal vision of nature transmogrified. As a member of the Catalanista Association of Scientific Excursions, he frequently took his sketchbooks on their jaunts and found inspiration for his work. At San Miguel del Fay just north of Barcelona cascades of white limestone and red bedrock captured his imagination and the germinal inspiration for the *Casa Milà* project (1905) was formed. Similarly, at Montserrat as a student assisting in a project for a sanctuary, he was awed by the windworn pinnacles of sandstone, phantom-like, in their austerity, almost prefiguring the monumental towers of the *Sagrada familia* and the *Park Güell* Cupolas. When the excursion group journeyed to the sea, Gaudí collected fragments of sea-washed rock. Cape Creus provided him with a plethora of organic sea forms that were themselves miniature pieces of architecture looking like the poured-concrete facades that were to drip and undulate on the Facade of the Nativity of the *Sagrada Familia.* The sea motif was obvious to a writer in the *Nuevo Mundo* who saw in the *Casa Milà* "grottos cut into the side of a cliff—a cavernous ocean—a habitable Atlantis (with) a rhythm of the sea." The poet Pujols saw it as "a sea of life" with a palpitating surface. There is no doubt that this was the intent of Gaudí for the green cement tile floors are set with starfish and octopi in relief, seaweed winds around the piers and the ceilings are inverted sand ruffled beaches. Grills of the *Casa Milà* are coral reefs and the ironwork of the entrys and balconies is tossled seaweed. Regarding this great edifice the architect confided to the writer José Plá that it was taken from the principle that straight lines do not exist in nature, for nature is not mathematical but a regular form, a dictum enunciated by Leonardo da Vinci in the 15th century. In his early notebooks Gaudí had formulated a concept of architectural forms: ". . . the more perfect they are, the less they need to be decorated." Louis C. Tiffany used the same approach when he stated that "No amount of ornamentation will ever replace purity of line." Both of these men realized the necessity of the primacy of form and ornament only to achieve secondary effects. Classical Hellenism absorbed Gaudí's interest, and he often rebuked those who criticized his excessive use of color on stone stating that the Greeks had polychrome temples, and that these were flooded with light; inside and out his temple would also be Hellenic, abundant with color, light and life. "The Greeks always painted their stone, even if it was marble, so that nothing of it could be seen." Gaudí having enunciated this factual bit of information added that it surprised everyone that he intended to polychrome the facade of the *Sagrada Familia,* and with a chuckle added that "people are surprised by anything." It shocked them when he began to ornament the whole structure with turkeys, hens, grass, cypress trees, angels cast from stillborn babies at the local hospital, saints cast from beggars on the streets, archangels from army buglers. The figures of fowl are not half so startling as are the mammoth forms of snails which have long been in repose in the empty nave of this great church. Standing well over ten feet tall, they have a surreal quality that suggests anything but cathedral design, but Pujols reminds us that Gaudí "did and said the strangest things, far removed from ordinary ways of thinking."

Under the patronage of Eusebio Güell Bacigalupi, it was possible for Gaudí to build the most beautiful park in all of Europe high above Barcelona on Montana Pelada overlooking the ravishing city and the blue Mediterranean. Over a decade earlier he had completed a lavish palace for his patron which in its plant-like search for light marked a point of departure from the more mannered *Colegio Teresiano* completed in the same year as the *Palacio Güell.* The landscape of Montana Pelada and its historical association with an older Roman colony evoked a unified personal concept of nature from which he was able to infuse life into a stark landscape. In its chalky soil he made plants flourish and flat surfaces gave way to undulating sinous lines exemplified by the lizard and dragon motifs. Every day Gaudí was present to supervise the work and to correct it if necessary, for he was as adroit at the laying of brick and tile as he was at forging iron or dreaming at the drawing board. It was a fusion of the harmonious dream of nature sculpture and architecture; although it included a "theatre of nature," it is better characterized in itself as a theatre of nature with transparent colonnades, sinuous paths and a dazzling vitrification of brick, ceramic, glass, porcelain, and stone muted only by a play of light and shadow from vegetation which was called forth from a montane desert. Columns are like inclined trees and stone animals abound everywhere. Entry pavillions resemble Moorish temples, probably derived from his earlier commission in Tangier, but with a rhythm that only Gaudí could summon. The entry house cupolas are crowned with mushroom-like hoods. The ironwork could stand alone as constructionist sculpture, but it is also unified with the whole having the freedom and light exemplified by the serpentine multicolored benches that writhe in the Catalonian sun showing the splendor of their porcelain and tile skin. It was this same light that he referred to as the "soul of architecture." How he would abhor the monumental tombs that pass as architecture today. When asked about the composition of a tower of his great cathedral, he replied that it was composed of light and gravity. He has worked against stasis, and all of the architecture is alive. Thus the *Park Güell,* while monumental, has a human feeling and was



Tangier Project (redrawn after Gaudí). Note the sea shell motif of the towers (drawn by Mary Butler).

A mock-up of shells revealing the source for the Sagrada Familia and the Tangier Project.

the initial urbanization of Barcelona linking the city and its people to nature and art—which Gaudí found inseparable.

In the *Paseo de Gracia* Jose Batlló Casanovas chose to have an edifice built by Catalonia's great genius. Since the *Casa Batlló* was underway at the same time as the *Park Güell,* it became in itself a sort of landscape, lyrical, undulating like flesh and exposing fine bone and muscle, and a scaly tile roof that resembles the back of a monstrous dragon. Eight windows have balcony ornamentation that from a distance look like masks with eyes of interlocking lashes. In a more intimate view they seem to be the maws of sharks. The multicolored facade is both sky and water with discs of varying sizes looking alternately like planetary phenomena and reflections in a sea of green violet and amber. Gaudí's original plans for the tile mosaics bore sea motifs giving some credence to the latter speculation. Like so many of these achievements of the master, the interior was an extension of the concepts enunciated in the facade; doors do not divide, but rather link rooms into a unity by an intrinsic rhythm of design as elegant and as well planned as the paths in the *Park Güell.*

In all of his architecture, Gaudí built according to precepts of nature; that is to say, he rejected the Gothic concept of building because it was not reasonable or sound according to the laws of nature. It is as though one were to expect flesh to support and maintain the form of a skeleton. Early in his work, he concluded that the buttresses, so pronounced in Gothic architecture, were the improper understanding of stress relationships. In his study of trees he found none of this external buttressing. As a result of such studies as well as mathematic and physical investigations into stress relationships, he concluded that forces are never exerted vertically so that dispersing thrusts on the outside of a structure was unsound. Thirty years of studying nature led him to the conclusion that an oblique parabolic order in which columns, like the trunks of trees, channel and balance the thrusts is a sensible disposition of stress. A bit more investigation would have revealed to him that this concept had been enunciated in 1748 by Giovanni Poleni who stated that the ideal construction of compression is a funicular curve in which the forces of tension are formed into pure compression. Nonetheless, more than one principle was gleaned from his stu-

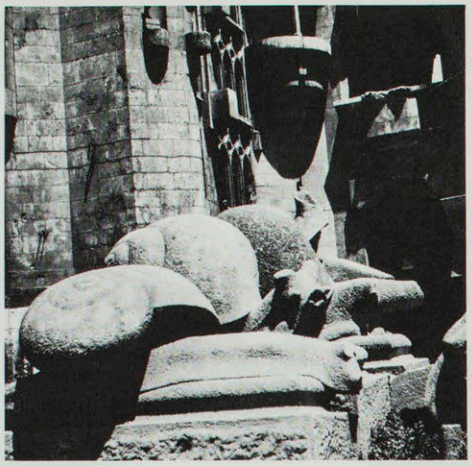
The Sagrada Familia, Gaudí's consummate work.

dies of nature, but a remarkable exposition of the aforementioned premise is the porticos in the *Park Güell,* and the reconstructed model for the apse and nave of the *Sagrada Familia.*

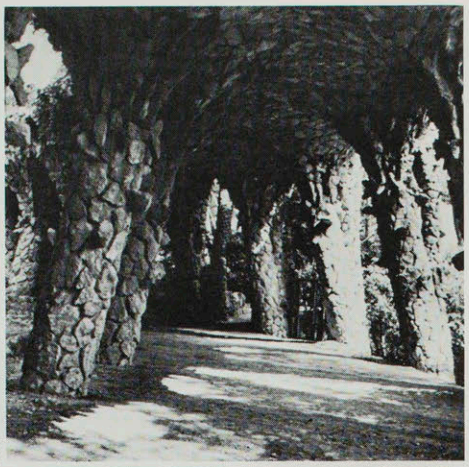
The tree motif had been exploited only in so far as architects of an earlier time had used the tree trunk as ornament on columns, but had never extended it to the logical apical divarication into ramifying branches that finger out from the trunk and contact the vault so that the pressures of the vault are diverted into each branch; in the absence of this, a column is primarily a passive unit that has little function. The reconstructed model of the *Sagrada Familia* shows such "forests" in the apse and nave. Where a vertical column with ramification was not used, Gaudi, quite logically, inclined the piers in the direction of the thrust of the vault; this is seen in the crypt of the *Colonia Güell* Chapel near Barcelona, in the projected *Passion Transcept* of the *Sagrada Familia,* and the several galleries of the *Park Güell* which support viaducts. Such an inclination of piers adds a dynamism and continuity to this architecture binding it to nature. Gaudí had seen trees inclined in this manner in response to the Mediterranean winds. A twisting and contortion of these same trees was captured in the spiral movement of many of these inclined columns; the spiral being emblematic of spiritual energy. Perhaps his greatest hommage to the tree is the cypress that surmounts the *Portal of the Nativity* as a central image in the *Sagrada Familia.* For Gaudí this was not only the tree of life, but was demonstrative of his profound Catholicism. The fruit of cypress trees opens to form a maltese cross, and the Mediterranean cypresses are majestic in their vertical thrust into the sky. Implanted on the branches of his cypress are doves, indicative of the abode of the Holy Spirit and a kingdom of peace. Gaudí was supreme in his understanding of the architectural dynamics of the tree, and yet in pious humility he always referred to the tree as his master.

Born in Campo Tarragona, more specifically Reus, Gaudí as a boy was impressed with the sea which he affectionately called his "real university" in which the three dimensions of space were synthesized. So passionate was he about this monstrous sea that he lamented to a journalist that it was unfortunate that Philip II established his court in Madrid because it was too far from the sea. "The

A *Euphorbia* reveals the architecture of nature which Gaudí sought to emulate.



Giant snails designed as ornament for the Sagrada Familia repose in the unfinished nave.



Inclined columns under a viaduct in the Park Güell exhibit a natural treatment of stress.

Slanted columns in the Park Güell have the aspect of seaside trees.

The Porter's House in the Park Güell capped by a mosaic mushroom.

sea has been and must be involved in the most stupendous enterprises of humanity," according to Gaudí. And as for light, Gaudí believed that only the light of the Mediterranean clarifies rather than distorts nature, and this is where all great artistic cultures have flourished. He had little use for the Northerners who based their philosophical aesthetics on abstracted concepts. Everything for Gaudí had to have a substantive reality drawn from the spirit and had to materialize like the fulfillment of prophecy—always in accord with nature. His was a visual empiricism which it was important to *see* and not to *know.* The eye with its voracious rapacity will give reality and veracity to all things. Catalonians are never deceived by reality, according to Gaudí, because they have a visual sense which allows them to feel beauty. Early in his career he studied Viollet-le-Duc's treatises on Medieval architecture and even visited such edifices in southern France, ultimately rejecting all of that for but one mentor—nature herself. Whatever affinity he might have felt for Hellenistic civilization and architecture was but an admiration for a people who had discovered in nature many of the same principles which he himself had found and had embraced. Air, light, space, color: all are there for those who have eyes to see and souls to respond. He transformed nature in a way that has been repeatedly emulated and never equalled. The works of Gaudí are sound; they have skeletons, flesh, and movement; they change and move with the changing light of day; they writhe, and sound comes out of them; their skin is covered with flowers; and like plants, they are well-grounded—rooted in Catalonian soil. They suggest the energy of the sea, light upon water, foam upon the ocean, and their architecture is as lyrical as that of the molluscs on the ocean floor. Living architecture for people, born of sea, soil, and sky—a reflection in the eye of a master-builder of nature.

William Emboden, our "Resident Exotic" has not missed a Gaudí edifice in Barcelona, and he loves to tell about it.

Sinuous, serpentine, mosaic benches writhe in the Catalonian sun (Park Güell).

The grand staircase of the Park Güell.

A graceful arc of mosaic flowers subtends massive pillars robbing them of their ponderous aspect.

A chimney finial on the Palazzo Güell.

Casa Batiló, the "house of bones", so called for reason of a skeletal facade.

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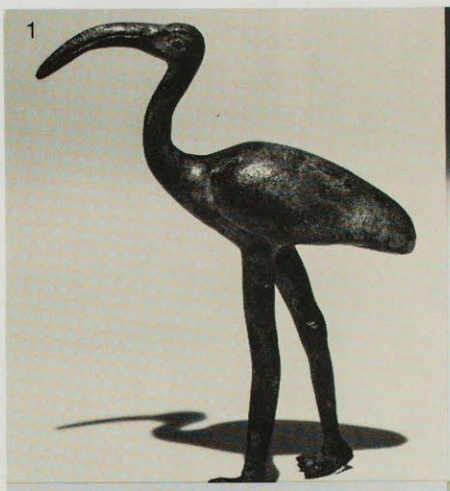
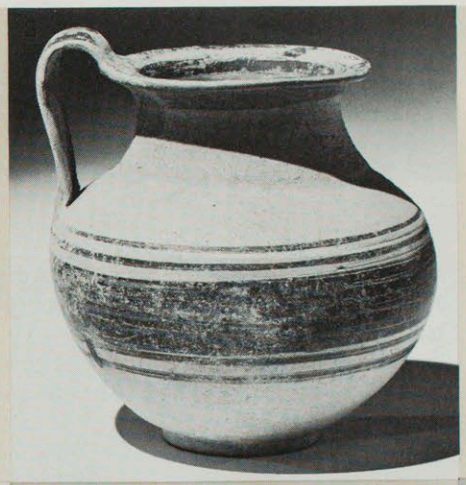
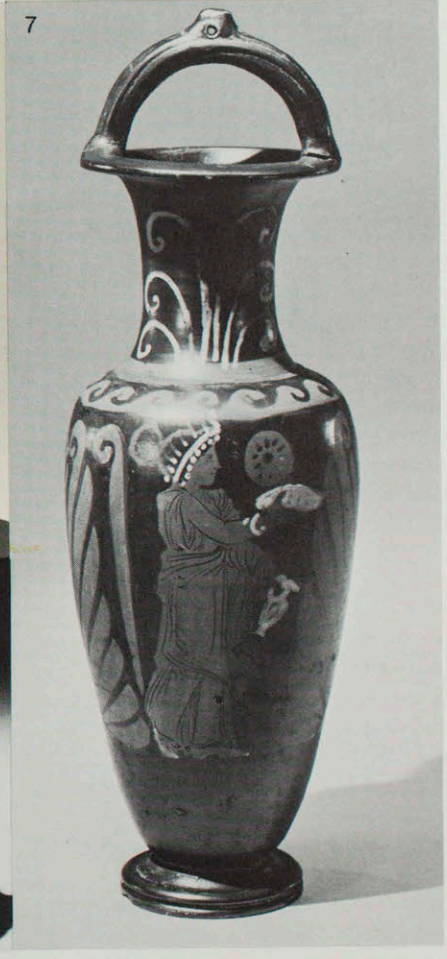






The Memorial Day Run In Los Angeles

by **Harry Kelsey**

Air pollution stole into Los Angeles like a thief in the night. Well, almost. There was actually a good bit of noise and commotion, but it did happen in the dead of night, when most dark deeds are done. It all started with an automobile.

A vehicle variously called a "Motor Wagon" or "Motor Cycle" or "Gasolene Carriage" or "Horseless Carriage" and said to be "the first of its kind in Los Angeles" had its trial run at three o'clock on Sunday morning, May 30, 1897. Few thought it would ever run at all, and no one even suspected the problems it would cause. One bleary-eyed reporter, looking for something nice to say about this ungainly contraption, said the new invention would help to free the horse from bondage, though he was a little vague regarding the social advantages that might accrue from equine emancipation. Others thought the automobile might be a positive blessing. No more fly-breeding manure piles. No more mosquitos, for the oil dripping from automobile engines would coat the roadside pools and destroy their breeding grounds.

The inventor of this wonderful boon to mankind was J. Philip Erie. The newspapers said he was "a wealthy New York civil engineer and inventor," but the real money came from a silent partner in St. Louis. In any case, Erie was probably not from New York. A year earlier, when he was still plain James P. Erie, he registered to vote in Los Angeles and swore then he was a native of California.

The builder of the new vehicle was S. D. Sturgis, who ran a machine shop with his brother at 208 West Fifth, near Broadway. Erie and Sturgis claimed to have finished a similar car a few months earlier, an odd-looking vehicle that refused to run. Surviving parts from the first model were now in the new invention. Whether the new Erie and Sturgis Gasolene Carriage was a success or a failure depends to a great extent on what paper you read.

According to the Sunday *Herald,* the vehicle "barely moved along," wheezing and gasping for several blocks on one cylinder, before it was finally hauled in for repairs. The *Times* reporter, who took an extra day for mature reflection, wrote a long illustrated article for the Monday edition of his paper. He pronounced the trial run a "gratifying success," reported that Erie had deliberately chosen to use only one of the four cylinders as part of his carefully calculated test procedure, and said the inventor could have driven his new car twenty-five miles per hour if he had wanted to.

In spite of the inventor's claim that the machine was covered by more than thirty patents, little or nothing about the car was really unique. The motive power was supplied by four one-cylinder engines, arranged in pairs and connected by universal joints. There was no starter; the crank was at the rear.

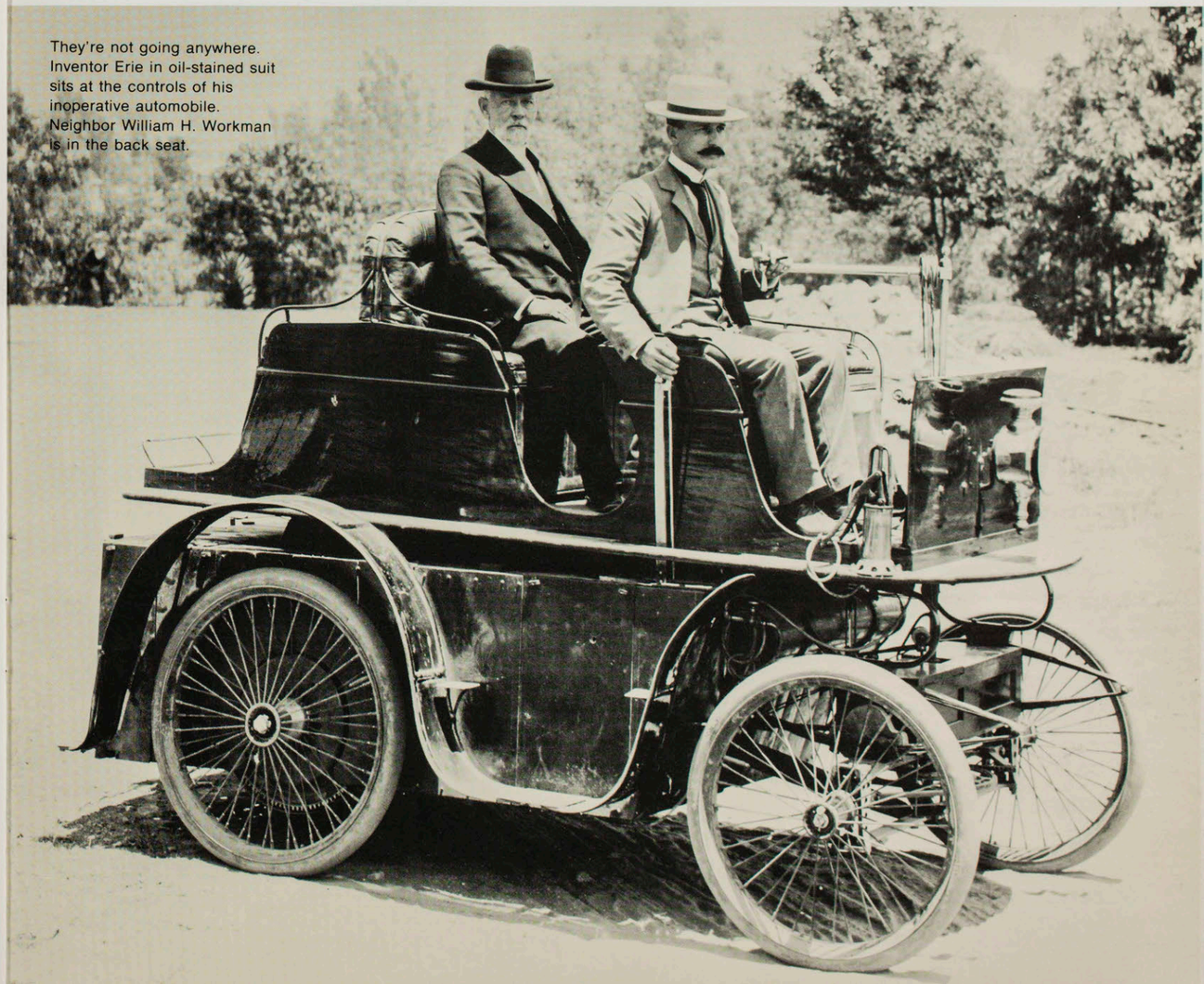
Gasoline—"ordinary stove gasoline"—ran directly from the tank to the cylinders, with a mixing valve in between. There were no spark plugs. A burner with a "hot tube" on each cylinder comprised the crude but effective ignition system.

A mechanism made up of "friction rollers" and "driving discs" served as clutch, transmission, and accelerator all rolled into one. Each cylinder or engine had a muffler—four in all—but the vehicle was still noisy. Steel drive gears were meshed with fiber gears in the differential assembly, a further attempt to reduce noise that again was only partially successful.

Heat was the great problem for Erie and Sturgis, one they were never able to solve. The engine compartment beneath the carriage was lined with asbestos, but the burners generated so much heat that Memorial Day Run that the protective covering "burned out like brown paper." Even with a fancy cooling device to spray water through the engine compartment air, the builders were unable to control the fiery emissions from their Motor Wagon.

For several days in early June, Erie and Sturgis promised to stage a public demonstration of their new invention, but the event never came to pass. The *Herald* announced a public run for Wednesday, June 3. It was cancelled. The *Times,* noting "slight defects" in the maiden performance, nonetheless said the asbestos problem was solved and all four cylinders would be in working order by Thursday afternoon. That trip was also cancelled, as was a promised run to Redlands on Saturday. The intense heat had cracked the cylinder heads, and new heat-resistant material had to be ordered from the mills at Homestead, Pennsylvania, "where the best steel is made." The new parts never arrived.

Although Erie promised to build a third and better automobile, his St. Louis partner apparently decided to cut his losses. Thirty thousand dollars was quite enough to invest in a horseless carriage that couldn't run as fast as a horse, smelled worse, and cost like sin.



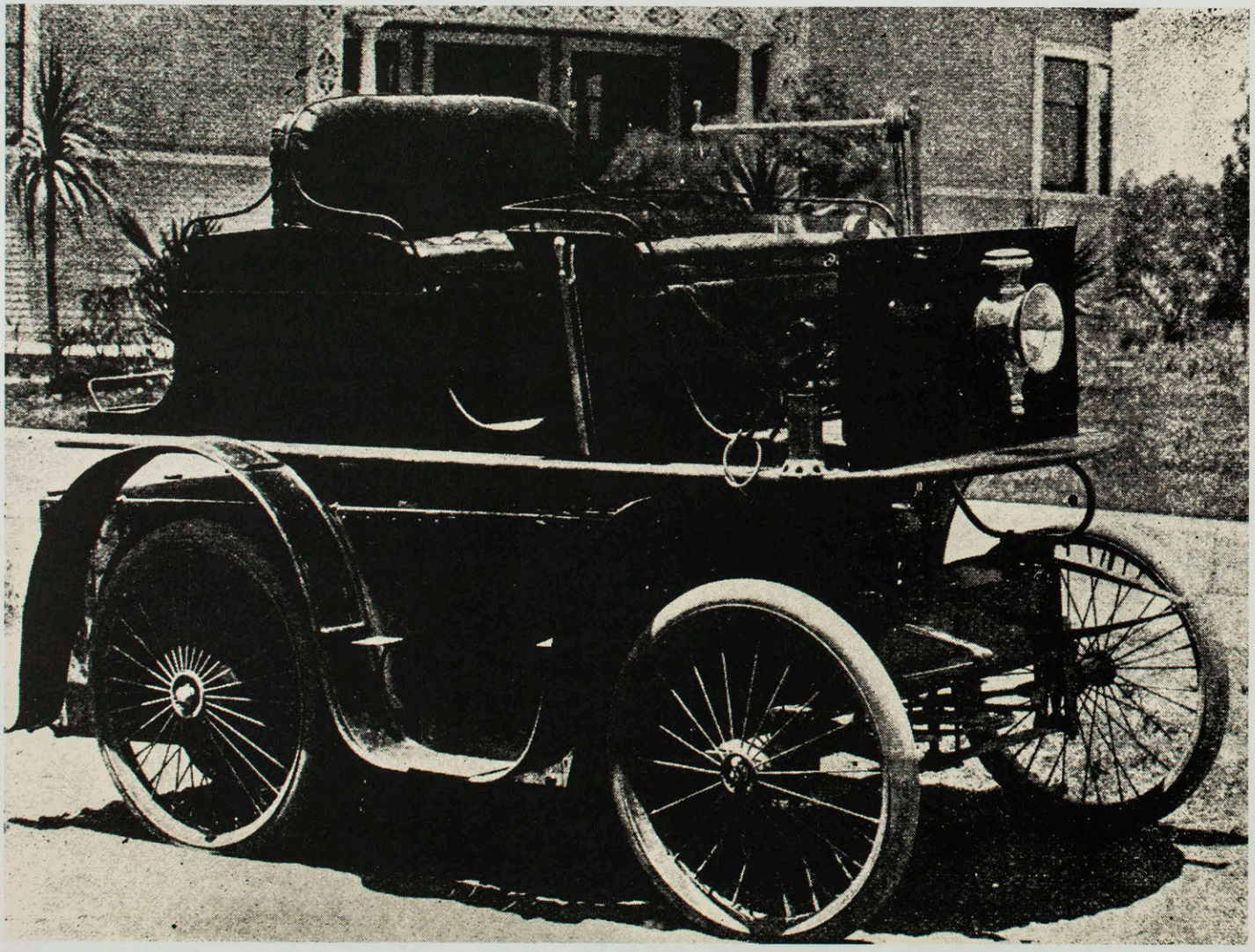
They're not going anywhere. Inventor Erie in oil-stained suit sits at the controls of his inoperative automobile. Neighbor William H. Workman is in the back seat.

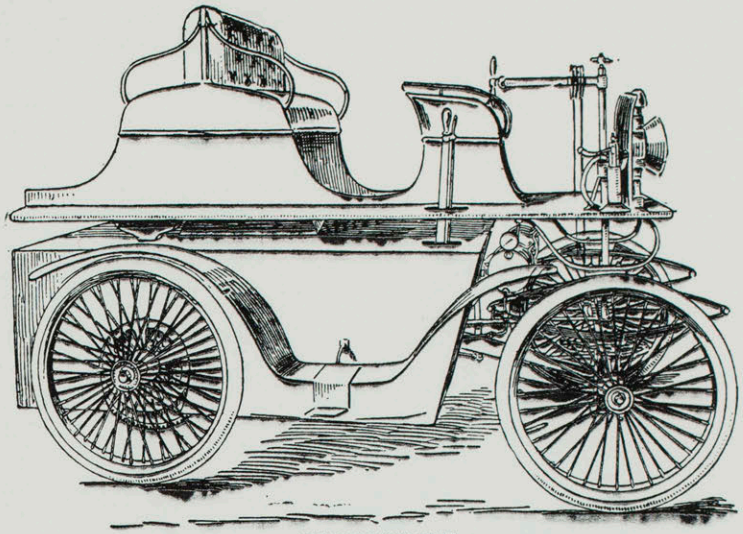
Sturgis continued to specialize in engine work, but Erie went on to other challenges. Within a year or so he was calling himself a "mining inventor," and by 1900 he had disappeared from Los Angeles altogether.

No one knows what happened to their automobile. It was last reported (June 4, 1897) in Erie's barn near Hollenbeck Park, "protected from fog and dew" and perhaps from incipient smog. The *Times* called it "the first motor carriage ever built west of the Mississippi River." That was wrong, though it was surely one of the first built in Los Angeles. The *Times* reporter also said: "In all probability it will not be long before a factory is established in Los Angeles for the manufacture of motor wagons." That statement was not wrong. Within a short time cars and trucks were being built in Los Angeles factories, and the automobile finally became almost a symbol of the city. It all started in the eerie darkness of Memorial Day, 1897.

Harry Kelsey is Chief Curator of History, Natural History Museum of Los Angeles County. His real interest is U.S. Indian Policy. The idea for this article, however, surfaced during research on the new History of Los Angeles Hall.

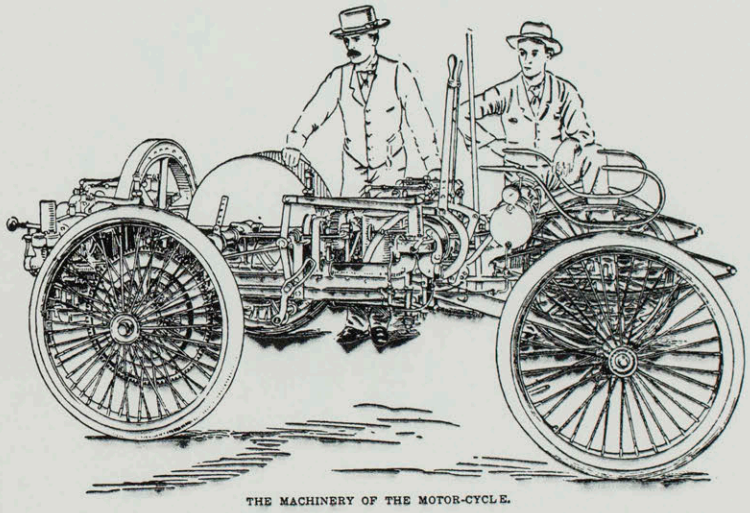
The Erie and Sturgis Horseless Carriage in front of Erie's home near Hollenbeck Park shortly after the Memorial Day Run. Note the flat tire on the right rear wheel.





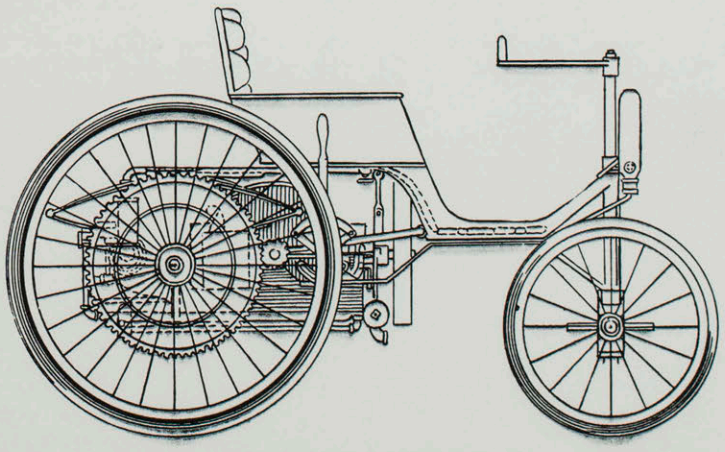
THE NEW MOTOR-CYCLE.

Drawing of the Erie and Sturgis automobile as it appeared in the Los Angeles *Times*, May 31, 1897.



THE MACHINERY OF THE MOTOR-CYCLE.

Inventor Erie inspects his creation in a *Times* drawing of May 31, 1897. The man on the right is probably S. D. Sturgis.



FIRST CARRIAGE OF ERIE AND STURGIS.

Erie and Sturgis Number One, an illustration from *Horseless Age*, July, 1897.

Intriguing Tahitian Trees

by **Robert Gustafson**

Tahiti, Moorea, Bora Bora—evocations of paradise. Black sand beaches, coral reefs, palm trees swaying in the balmy breeze—all conjure up the lure and romance of the South Seas. The Marquesas, Tuamotus and Society Islands comprise French Polynesia—the Elysium of the South Pacific. On these remote islands located midway between Australia and South America, life continues at a leisurely pace. Although progress is evident in Papeete, the largest city in the Society group, most of the islands are removed from the ravages of industrialization. How long this placid life style persists remains to be seen, but the prognosis is not favorable. It seems a shame to witness the destruction of the stately Alexandrian laurels, the majestic barringtonias and the curiously-tiered country-almonds—all prolific, arboreal giants scattered along the coastal zones. The traveler who seeks a respite from the monotony and turmoil of a modern metropolis is surely to be impressed and inquisitive about the luxuriant vegetation of these volcanic haunts of Cook, Bligh, Gauguin and others. Many plants arrived by way of the sea, some by birds, others by wind and intentionally or not, many by man himself. A brief look at some of the trees found growing on or near the sandy beaches of Tahiti and Moorea reveal that these unusual verdant denizens are utilitarian, some medicinally, others commercially.

Perhaps the most ubiquitous tree of tropical beaches is the coconut *(Cocos nucifera)* of the palm family. The coco palm's origin is obscure, since it was widely distributed even in prehistoric times. Its curved, annulated trunk may attain a height of one-hundred feet, while the leaves often exceed fifteen feet in length. Trees usually bear flowers and fruit at the age of six years—the number of nuts often exceeding forty annually. A mature coconut takes nine months to fully ripen. It is more or less pyramidal in cross-section and may be over a foot long. A thick husk encloses the tough, thin-shelled nut which has three pores at one end, one of which is situated above the embryo. Oily, white pulp lining the side of the nut encases a hollow filled with sweet liquid (milk). Because of the buoyancy and impermeability of the husk, coconuts are carried great distances by ocean currents, although their ability to germinate is lost after 4 months in salt water.

Coconuts are commercially important, since they yield both copra, the ripe kernels or meat of the fruit, and coconut oil, a pale yellow liquid, a semisolid or a hard rather brittle solid depending upon the temperature. Shredded coconut of cooking and confectionery is derived from copra which has been sun-dried, sweetened and cut into thin shreds. Oil is employed in margarines, soaps, cosmetic creams, hair pomades, candles and pharmaceutically in ointment bases.

The advent of the coco palm in Tahiti is obscure. Inhabitants use the milk for seasoning raw fish and pork; fermented as an alcoholic beverage; as a fuel for burning in lamps; as a hair dressing, body lotion, and a preventative against sunburn. Ancient Tahitians used the shell to repair skull fractures, a custom no longer in practice. Leaves have a variety of uses such as: headgear, mats, folding-screens, baskets, roof-thatching. The trunk is often employed for fences or poles supporting thatched roofs.

Many myths surround the origin of the coco palm, every island group having its own variation. An old Tahitian legend, as reported by P. H. Buck, recounts the following tale: "Tuna, the conger-eel, who was Sina's lover, was killed by jealous suitors, but when he had seen Sina for the last time, he had altered her to his destiny. He commanded her to come and cut off his head after his death and to plant it. From his head a tree would grow, and its fruit would feed and quench thirst at the same time. On the fruit she could find again the two eyes which had adored her, and the mouth which had whispered sweet love words. Thus it was that Sina planted the head, and the coconut tree sprouted."

Casuarina or "Aito" *(Casuarina equisetifolia)* of the Casuarina family is also known by other names: beefwood, she-oak and ironwood. The generic name is derived from the similarity of the drooping needles to the feathers of the cassowary, a large flightless bird of the Arawak Islands. Leaves are reduced to scales which form a sheath at the joints of branchlets, giving the tree a pine-like appearance. Both staminate and pistillate flowers appear on the same plant, the former in long, acicular spikes at the tip of the branchlets, the latter in reddish tufts at the base. Small brown one-inch cones often litter the beach. Most of the species of this genus are native to Australia, but *C. equisetifolia* is a common endemic of the islands in the South Pacific and Malaysia. The name "ironwood" is derived from the heavy density of the wood, "beefwood" from the reddish color of the sap, and "she-oak" from the sound of the wind blowing through the needles.

Ship stem-posts, weapons, tools and carvings are manufactured from the hard, insect-proof wood. In other areas the bark is employed in tanning, dyeing and medicinally as an astringent. The tree is often planted as a windbreak, especially along the coast where it is seemingly impervious to salt spray.

Tahitians attribute strange powers to the ironwood. According to legend it grew from the bodies of warriors whose blood became the red sap and their hair the needle-like branchlets. Other interpretations of its origin appear throughout Oceania—all fascinating and mysterious. W. Somerset Maugham named a selection of six short stories concerning English settlers in the outposts of Malaya, "The Casuarina Tree," because, like his countrymen, the tree was "gray, rugged and sad; out of place in the wanton tropics." And it would seem that way.

Catappa, country-almond or "autera'a" *(Terminalia catappa)* of the combretum family is a large or small tree with widely spreading, horizontal branches giving it a curiously-tiered appearance. It is most abundant on sandy shores where it has become pan-tropic in distribution, although it undoubtedly originated in the East Indies. Large, subovate leaves to a foot long turn a deep red before they fall, and in July the tree is practically deciduous. Inconspicuous, fetid flowers borne on six-inch spikes are followed by an ovoid, greenish-purple, flattened fruit resembling an almond. The tough rind surrounds a hard case with one or two edible kernels that contain a valuable oil. When ripe, the fruit becomes more or less spongy in texture, thus adapting itself for dissemination through the agency of ocean currents.

Country-almonds are eaten by children—the taste being not unlike that of a hazel-nut. Roots, bark, leaves and fruit are utilized commercially and medicinally. Catappa oil is sometimes used as a substitute for almond oil. In India, the fruit is the source of a black dye, either as ink or for coloring the teeth. In Malaysia the bark is employed as an astringent and in treatment of dysentery and thrush. Both bark and leaves are effective in tanning leather.

The Alexandrian laurel, "tamanii" or "ati" *(Calophyllum inophyllum)* of the mangosteen family, is a stately, branching tree often exceeding sixty feet in height. Slow-growing and gnarled with rough gray bark, this handsome plant is covered with shiny, leathery, oblong

Coconut palms on Moorea

Coconut palm

Breadfruit

leaves which are characterized by numerous fine parallel veins. Clusters of small white flowers with masses of showy yellow stamens exude a spicy fragrance when newly opened. Globose, green, one-inch fruits have a coarse, thin skin that covers a bony shell surrounding a partly toxic kernel encased with cork.

Commercially the seed is known as "punnai nut" from which is expressed a heavy, greasy, deep green oil known as "dilo" or "domba," characterized by an unpleasant taste and an aromatic scent. Refined oil, when intramuscularly injected, is said to relieve pain of leprosy. Formerly Tahitians used dilo as a hair pomade and as an anodyne for sores, scabies, rheumatism and open wounds. Roots, bark and leaves are medicinally beneficial. The wood is an excellent timber for boat-building, cabinet work, and carving. It is hard, durable, close-grained and takes an excellent polish.

The "hutu" *(Barringtonia asiatica)* of the brazil-nut family is a handsome tree endemic on all islands of the South Pacific and northwest to India. This magnolia-like plant has large, glossy, ovate leaves up to eighteen-inches long, somewhat resembling those of the catappa, clustered at the ends of the branches. Unfortunately the rather spectacular flowers which open in the evening and fall by morning are seldom noticed. Resembling a giant powderpuff, the white, pink-tipped mass of three-inch stamens are subtended by four large white petals. The sweet redolence of the blossom is quite conspicuous. Perhaps the most curious aspect of the hutu is the four-inch, quadrangular, heart-shaped fruit resembling a bishop's mitre. It has a spongy, fibrous husk containing one seed which is poisonous and bitter. Tahitians and other natives of Oceania utilize the seed which contains an oleaginous, bitter substance. Seeds are grated and tossed into the sea to stupify (but not poison) fish, allowing them to be easily caught and consumed without danger. Canoes are often dug from the light, hard wood which splits readily. Food is wrapped in the leaves before they are placed in ground ovens. Fruits make excellent floats for fishnets because of their buoyancy. Tahitians claim that the barringtonia arose from the human heart whence it derives its common name "hutu" (or "hotu").

"Fau," "Burao" or hau *(Hibiscus tiliaceus)* of the mallow family is a common small tree or large shrub that grows near the sea. Although pantropic in distribution, it may have originated in the Old World. A polymorphic plant, it might form a thicket of tangled trunks and twisted branches over the ground, or it might be a more or less erect tree with a tortuous trunk. Large, cordate, leathery leaves often reach a foot in diameter, smooth on top and tangled with white hairs beneath. In the morning showy flowers with a maroon center open a bright, clear yellow, changing to a coppery orange later in the day and finally to a pronounced red before they fall in the early evening. Fruiting capsules are not conspicuous but bear three smooth seeds. Fau is shallow-rooted and resistant to salt spray. It thrives in both water-logged and extremely dry situations.

Roots, bark and flowers have medicinal properties. Roots are consumed and the mucilaginous bark serves to relieve thirst. In the Phillipines, fresh, macerated bark placed in water is considered efficacious in treatment of dysentery. Other therapeutic uses of this plant include that of a diuretic, a febrifuge, an emetic and an emollient. Tahitians utilize the leaves by binding them together into flat cushions to cover food in an open-pit oven. Tapa is manufactured from the mature bark. New, smooth bark is stripped and twisted into rope which is

Screwpine

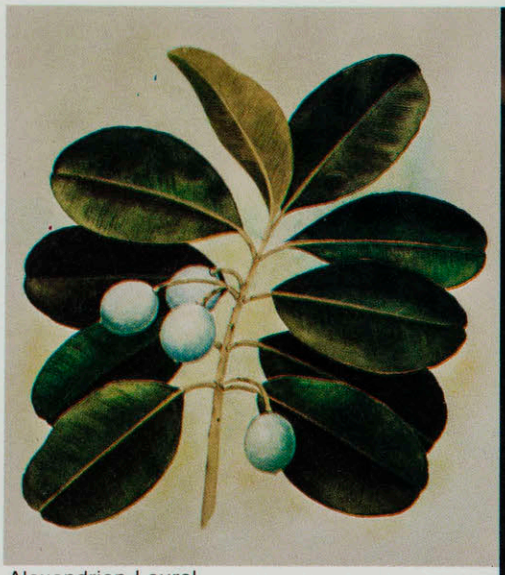
remarkably strong. The light, tough wood makes excellent paddles, outrigger canoes, house frames, etc. In Fiji, the fibre is used in making women's grass skirts. In Samoa, bark is still utilized for straining kava, a slightly narcotic beverage, while in the East Indies it is fashioned into cordage and as tow in boat caulking. According to Tahitian legend the fau is the grandchild of heaven and earth.

Breadfruit or "uru" *(Artocarpus communis)* of the fig family was present in Tahiti before Columbus discovered America, but it originated in Indonesia. Among the aristocrats of tropical trees, it is as widely planted for its edible fruit as for its handsome foliage. The leathery, incised leaves are often a yard or more in length. Male and female flowers grow separately on the same plant, but their appearance is markedly different. The staminate is an erect, club-shaped, greenish-yellow spike, six to twelve inches long, while the pistillate is a large globose green head. When fully mature, the tuberculated, green or brown fruit may weigh up to ten pounds. Several varieties are in cultivation, mostly from cuttings, since seed production is not evident on many trees.

Perhaps the breadfruit's greatest claim to fame centers upon the famous Bounty incident. Bligh discovered the tree on Captain Cook's second expedition to Oceania (1772-74) whereupon he was nicknamed "breadfruit Bligh." In 1787 he set out on the HMS Bounty to obtain plants for transport to the West Indies where it was to be cultivated as a cheap food source for slave labor. Mutiny erupted in 1789 and Bligh and eighteen loyal followers were set adrift with little in the way of provisions. After a trying journey of some 3600 miles in an open boat, he eventually landed at Timor in the East Indies. Bligh's second expedition to Tahiti in 1792 was a resounding success—over 1000 young breadfruit trees were brought to Jamaica and thus disseminated throughout the Caribbean. Lord Byron's poem "The Island" commemorates this event. Ironically, the popularity of this plant never achieved any remarkable success in the West Indies.

Breadfruit is prepared in a variety of ways—most commonly baked whole in an open-earth oven. It is also boiled, fried or cut into thin strips and sun-dried. From these slices a flour is prepared which is used in puddings, bread and biscuits. When picked prematurely, the white mealy pulp has a consistency resembling that of freshly baked bread. The sometimes sweetish taste approximates that of a plantain (a member of the banana family) or an "earthy" potato. Its pulp is high in carbohydrate and a good source of vitamin B. A fermented dough called "popoi" was formerly made from it. Sometimes the male inflorescence is candied and eaten as a delicacy. Tapa or barkcloth is made from the fibrous inner bark of the young branches. Glue and caulking material for ships are derived from the viscid, milky juice which exudes from incisions on the stem. The durable red wood is utilized in the construction of canoes, furniture and carvings.

According to Tahitian myth, the first breadfruit appeared as a gift from a devoted and loving father in time of severe famine. One night he told his wife to go outside the following morning. His hands would become leaves, his body the trunk and branches, his head the large round fruit, and his tongue the heart inside. He instructed her to roast the fruit, soak it, remove the skin and feed it to the children and herself so that they might not starve. Not understanding his words until morning, she discovered a strange tree outside the hut. She wept while gathering the fruit thus their needs were met.



Alexandrian Laurel

Alexandrian Laurel

Screwpine or "fara" *(Pandanus odoratissimus),* of the screwpine family, is easily recognized by the aerial roots emerging from the trunk, giving the impression that the plant is propped up by sticks. A widely branching tree to twenty feet or more, it is commonly encountered on sandy beaches throughout most of the Pacific. Leaves a yard long and two or more inches wide are spirally arranged at the ends of the branches. Male and female flowers appear on separate plants, the former a long spike enclosed in narrow, fragrant, edible, white bracts, the latter a large, globose head resembling a pineapple.

Male flowering spikes, called "hinano," are commercially important as the source of an essential oil in perfumery by enfleurage, a process in which scents are extracted by exposing absorbents, such as fixed oils, to the exhalations of flowers. This oil, known as "kevda," is also employed medicinally in the East Indies as a stimulant, antispasmodic, purgative, antiseptic and in treatment of leprosy. On low coral islands, as in the Tuamotu archipelago, the fruit of the screwpine is the only vegetable food source with a reasonably high sugar and starch content. In Tahiti, however, it is not consumed because of the pungent taste. The fleshy anterior of unripe fruits are strung into leis, having a fragrant, pumpkin-like odor. Throughout the Pacific, leaves have served as important materials since ancient times. In order to utilize the leaves for plaiting, the spiny margin and midrib must be removed, followed by curing the unusually pliable, sturdy fibres. Once accomplished the fibres are employed in weaving baskets, mats, roof-thatch, bags, canoe-sails, and hats. Viscid sap from the stem of the fruit is utilized in the preparation of an alcoholic beverage. Aerial root tips not touching the ground are often roasted, somewhat reminiscent in taste of sweet potato or yam.

In addition to these endemic species, a number of important trees have been introduced into the Society Islands: cashew, mango, papaya, avocado, soursop, custard-apple, leechee, pomegranate, tamarind, citrus, guava, candle-nut, ylang-ylang and frangipani—all frequently encountered in cultivation. Yet it is the trees that spread their arching branches over the white and black sand beaches of these volcanic islands that evoke the visions of paradise that Michener wrote about in his "Tales of the South Pacific." If Bali Hai be only a fictional landmark immortalized in prose and song, one has simply to view Cook's Bay on Moorea to realize the inspiration.

Robert Gustafson, Assistant Curator of Botany, while not sharing Captain Bligh's passion for breadfruit has a grand passion for islands and has recently surveyed the flora of the Society Islands, the Aegean Islands and the Caribbean Sea.

(Watercolors by Mary Butler)

Barringtonia or "Hutu"

Ironwood

Ironwood or Casuarina

Sea Hibiscus or "Fau"

Screwpine

Country-Almond

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